Maturity Transformation Risk, Profitability and Stability in Islamic Banking: A New Macro-prudential Liquidity Perspective

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of the requirements for the Degree of

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by

Haroon Mahmood

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In the Name of Allah, the Most Beneficent, the Most Merciful

Dedicated to my lovely wife Dr. Kiran Munir, adorable children Ahmad Haroon and Izzah Haroon, dearest parents Sabiha Mahmood and Shahid Mahmood (late), for their love, trust and support.

Abstract of a Dissertation submitted in partial fulfilment of the requirements for the Degree of PhD in Accounting and Finance.

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Maturity transformation risk and bank liquidity management practices have drawn substantial regulatory attention, in the wake of the 2007-08 global financial crisis. To harmonize the robust management and monitoring of maturity transformation risk in the Islamic banking industry, while endorsing Basel III liquidity regulations, the Islamic Financial Services Board (IFSB), recommended the implementation of a modified net stable funding ratio (NSFR). This was designed for Islamic banks as a structural measure for the maturity transformation function, to account for their unique balance sheet structure. This macro-prudential measure of maturity transformation risk refrains the banks from excessive reliance on unstable short-term market funding, which adversely effects banks' financial performance and stability.

Using a data-set of 55 full-fledged Islamic banks, from 11 different countries, over the period of 2006 – 2015, this study investigates the factors that are significantly associated with the maturity transformation risk in Islamic banks. We further investigate the causal relationship of maturity transformation risk with the profitability and stability of the Islamic banking sector.

We utilize a two-step system Generalized Method of Moments (system-GMM) dynamic panel data estimation technique, on unbalanced panel. The empirical results reveal bank size, capital, and external funding dependence are significant contributors of increased maturity transformation risk. Whereas, less-risky liquid assets, risky liquid assets, and market power are limiting factors to the maturity transformation function of Islamic banks. Among the macroeconomic variables, inflation shows significant positive impact on the banks' maturity transformation risk, during the sample period. However, we find no evidence for the effect of

bank credit risk and economic growth on maturity transformation risk in the Islamic banking system.

This study provides empirical evidence of a negative association of maturity transformation risk with the profitability of Islamic banks, suggesting the beneficial effects of the inclusion of the new regulatory liquidity requirement in Islamic banks. Besides, bank capital, asset quality and concentration are other important factors that influence banks' profitability during the study period. Furthermore, the positive relationship between NSFR and stability supports the need to implement IFSB's proposed NSFR requirement for the long-term resilience and stability of the Islamic banking industry. The results of this study remained consistent after applying a series of robustness checks including alternative measure of dependent variables, alternative estimation techniques and after controlling for industry-specific and macroeconomic factors.

Keywords: IFSB, Islamic banking, net stable funding ratio, system-GMM

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Chapter 1

Introduction

1.1 Introduction

The world has witnessed the exponential growth of Islamic banking and finance over the last four decades, not with regards to its existence and the unrestricted geographical dispersion beyond the borders of Islamic states, but also through increasing numbers of banks/branches, accounts and invested capital (Khan, 2010). Many of the leading international conventional banks, such as ABN Amro, Bank of America, Barclays, Citigroup, Deutsche Bank, HSBC, JP Morgan, Lloydes TSB, Standard Chartered, have begun offering Islamic products and services through their Islamic windows. By virtue of global financial liberalization, Islamic Financial Institutions (IFIs) have become important players in the global financial system. The latest statistics estimate the managed asset value of IFIs between US$ 1.816 and 2.1 trillion (at the end of 2014). The last five years' compound annual growth rate sits at around 17%, of this, Islamic banks hold more than 80% share, with a growth rate of 14% over the period of 2009 to 2014 (ICD & REUTERS, 2015). There are more than 614 Islamic financial institutions, including Islamic banks presently operating, in almost 75 countries (Farahani & Dastan, 2013). Four hundred and twenty of these institutions offer exclusively *Shari'ah*[1] compliant products and services, while the remaining 194 are conventional institutions which provide financial services through their Islamic windows. From its infancy stage, Islamic banking and the associated financial institutions, have transformed from an ambiguous experimentation project into a key player in the global finance market (Khan, 2010). For example, the Islamic banks of Gulf Cooperation Council (GCC) countries outgrew their conventional peers between 2009 and 2012. They showed a compound average asset growth of 17.4%, compared with conventional banks' 8.1% during the same period. Furthermore, their net lending and customer deposits grew by an average of 18.2% and 19.9%, compared with conventional banks 8.1% and 10%, respectively (Holmes & Kathpalia, 2014). Figure 1.1 shows the recent growth trend of Islamic banking and global Islamic financial assets. Although Islamic banks are

[1] A set of Islamic principles based on the teachings of Quran (Holy book of Muslims) and Sunnah (deeds and sayings of Prophet Muhammad PBUH)

concentrated more in Muslim majority regions, such as the Middle East, Southeast Asia and Africa, their existence is gaining prominence in several parts of the US and Europe. For example, the UK plans to become the global Islamic banking hub in the region (Kerr, 2007). According to Hasan and Dridi (2011), Islamic banking has gain prominence because of its superior performance and resilience shown during the recent 2008 global financial crisis.

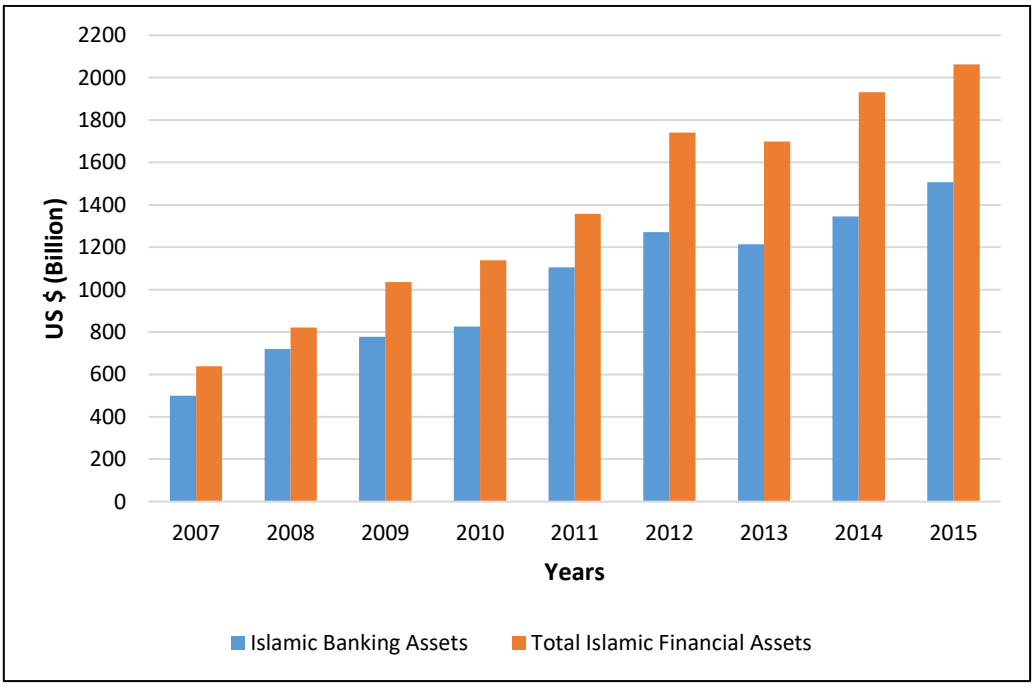

Figure 1.2 Growth Trends in Islamic banking and Total Islamic Financial Assets

Sources: KFHR, IFIS, GFIR, ICD-Reuters (2017)

The exponential growth in the Islamic banking industry does not mean that Islamic banks are free from risks in the global financial environment. Similar to their conventional counterparts, Islamic banks also face various types of risks due to contemporary changes and developments in the global financial market, along with the recent financial crises, which have generated much financial distress and created challenges for the world's economy. Moreover, Islamic banks face additional risks because of their unique and complex nature. According to El Tiby (2010), maturity transformation risk, fronting Islamic banks, is among the most critical risk. The main risk factors are outlined below:

i. Limited *Shari'ah* compliant financial instruments, listed in the secondary market, which call for the institutions or regulators to increase participation in asset-based securities such as Sukuk (Ismal, 2008).
ii. Existing liquidity management options, such as secondary markets for debt instruments, interbank money markets and lender of the last resort (LOLR) are based on interest rates (riba), which are prohibited by *Shari'ah* law (Islamic finance). This presents a huge challenge to Islamic banks in meeting their time to time liquidity requirements.
iii. The unique specifications of the Islamic financial contracts, such as cancellation risk in *murabaha* instruments, restrictions on refinancing or contracts, such as *bay salam*, that can only be traded at par value, pose additional limitations to manage liquidity in Islamic banks.
iv. Absence of adequate depth in *Shari'ah* compliant money markets also restricts the ability of Islamic banks to effectively manage liquidity.

Islamic banks depend largely on their customers' deposits as their main funding source. This is due to the restrictions on refinancing as well as lack of the lender of last resort facilities (Dusuki, 2007). Their deposits can be divided in two main forms– non-remunerative accounts, as *Wadiah or Qard Hassana,* and remunerative accounts, as unrestricted *Mudarabah,* where the latter accounts for two-third of the total deposits of Islamic banks (Visser, 2013; Fakih, 2009). Thus, Islamic banks have restricted opportunities to perform term and risk transformations, which are two of the main functions of most intermediary financial institutions (Bryant, 1980). This impacts on their liquidity transformation (Berger & Bouwman, 2009; Bhattacharya, Boot, & Thakor, 1998). Subsequently, Islamic banks may be exposed to potential risks associated with growing asset-liability maturity mismatches. Furthermore, there is no explicit or implicit deposit insurance in the Islamic banking system (Archer & Karim, 2013). This may provide incentive for the Islamic banks to follow risk absorption hypothesis, which advocate increasing capitalization and decreasing bank-risk-taking (Merton, 1977) while performing their liquidity transformation function.

Banks, whether conventional or Islamic, create liquidity through their maturity transformation function. This process is considered to be a primary role of banking institutions. The theory that posits banks acquire short-term deposits to finance loans for a

longer term and thereby contributing towards the economic development, has long been established by Smith (1937). In contemporary banking, the idea that the liquidity creation process is fundamental to banking institutions was prominently rejuvenated by Bryant (1980) and Diamond & Dybvig (1983). These studies argue that banks create liquidity by accepting relatively liquid liabilities (fund deposits) and making relatively longer term- illiquid assets (loans). While doing so, banks as intermediaries, hold illiquid assets and provide cash to the economy. Although such transformation offers the underlying principle for the existence of banks, this prime role is also attributed to the intrinsic maturity transformation risk, such as mismatch of maturities in a bank's assets and liabilities (Berger & Bouwman, 2009). Further, the banking system undergoes continuous change and rapid development due to increasing globalization of the financial markets in a highly volatile environment. This leads to the increasing use of multifaceted financial instruments by many large banks, imparting severe challenges related to their liquidity transformation ability.

A financial institution is said to be liquid when it is able to meet all legitimate demands for funds (Yeager & Seitz, 1989). Garber and Weisbrod (1992) refer to liquidity as the banks' ability to transform illiquid assets into more liquid liabilities, with minimum losses. In the financial system, bank liquidity is broadly categorized into *asset liquidity* and *funding liquidity*. The former refers to the ability of a bank to offset its assets position, either by selling or through securitizing a non-monetary asset, at market price without incurring substantial losses (Van Greuning & Bratanovic, 2009). Whereas, funding liquidity corresponds to the bank's ability to access external funding sources by attracting more deposits or by issuing debt or equity securities in the interbank market (Gatev, Schuermann, & Strahan, 2009).

Despite their distinct natures, both funding liquidity and asset liquidity are considered to be closely interrelated (Brunnermeier & Pedersen, 2009). A relatively high leveraged bank that is unable to, or unwilling to sell its assets when required, warrants for adequate funding liquidity. Similarly, an institution that faces difficulty to fulfil its depositors' obligations on time, would likely sell or securitize assets, which becomes difficult if it holds a large proportion of illiquid assets. As a result of the mutual interaction of both funding liquidity and asset liquidity, unexpected withdrawals from depositors are likely to increase from the available amount of cash that a bank holds. Consequently, such imbalances may result in a reduction of the banks' asset liquidity, thereby generating *asset liquidity risk* or exposing banks to

funding liquidity risk through potential deposit run-offs. The mutual interaction of asset liquidity risk and the funding liquidity risk limits the banks to meeting its obligations regarding its borrowers or depositors, hence exposing them to *maturity transformation risk*.

Matz and Neu (2006) discuss bank maturity transformation risk in relation to three dimensions. The first dimension corresponds to the "structural or mismatch liquidity risk," that exists because of the maturity mismatch and asymmetry of commitments in the structure of the on-balance sheet and off-balance sheet items. The second dimension focuses on the "contingent liquidity risk." Since a bank is exposed to various inherent risks because of the functions it performs, every additional risk factor attracts more liquidity requirements that can result in the distortion of bank's balance sheet structure, hence exacerbating maturity transformation risk. The third dimension is the "market liquidity risk," where banks either bear higher losses than expected, to off-set their asset position in more illiquid market conditions, or are unable to meet unexpected customer withdrawal because of reduced funding options. In broader terms, the more the banks perform liquidity creation, the higher risks they face in terms of losses while offsetting their illiquid assets. Consequently, banks (both Islamic and conventional), may be forced to sell their assets in times of distress, to meet the liquidity demands of their customers (Berger & Bouwman, 2009; Allen & Gale, 2004). A bank's inability to meet its obligations towards its borrowers or depositors may not only cause classical *bank run* but also the contagion effect may impair the solvency of the entire country's financial system and ultimately paralyse the country's economy.

The fundamental function of bank liquidity creation, as well as the depositors run on banks, provide rationale for bank regulations. Additionally, the increased interdependence of banks, has worsened the impact of failure of any given bank on the stability of the overall financial system; in short, the current banking system is more exposed to systemic risk. Indeed, explicit or implicit deposit insurance has become a commonly used tool in almost all countries, to protect depositors and to avoid bank runs, especially after the 2008 global financial crisis (Demirgüç-Kunt, Kane, & Laeven, 2015). Furthermore, regulators also take on the role of the lender of the last resort, to fund banks that are unable to access external funding sources. Even though such mechanisms mitigate the risk of depositors run on banks, as well as systemic risks, they also provide incentive to banks to engage in greater moral hazard behaviours. For example, banks may find incentive to take greater risks if deposit insurance

premiums are undervalued. Moreover, the implicit guarantee provided by the lender of the last resort (in case of financial distress) may encourage banks to invest in more risky assets. To discipline the banks in their risk taking behaviour or to avoid depositor runs on banks, the Basel Committee on Banking Supervision (BCBS) has recommended several capital and liquidity standards for regulators. More recently, the BCBS has proposed guidelines to manage bank liquidity in the Basel III accord (BIS, 2010). Among them, the Basel III accord includes the implementation of net stable funding ratio (NSFR) across the global financial system. This ratio is a micro-prudential measure of maturity transformation risk that limits banks' excessive reliance on unstable short-term funding (Arvanitis & Drakos, 2015). In an attempt to harmonize the robust management and monitoring of liquidity risk in the Islamic banking industry, the Islamic Financial Services Board (IFSB), an international standards-setting body for Islamic financial institutions, has endorsed the implementation of NSFR in the global Islamic banking industry. The IFSB proposed a modified NSFR in Guidance Note No. 6 (GN-6), to account for the unique characteristics of the Islamic banking sector (IFSB, 2015).

1.2 Purpose of the Study

The aim of this study is to analyze the impact of operational and market restrictions, with regards to *Shari'ah* compliant financial instruments, and refinancing options, as well as the macroeconomic factors on the maturity transformation function of Islamic banks. These restrictions significantly affect the liquidity creation of Islamic banks. Previous studies that have examined the intermediation functions of Islamic banks, and particularly the liquidity management requirements, theoretically or empirically, are either restricted to one country or are descriptive in nature (Bacha, 2008; Brown, Hassan, & Skully, 2007; Iqbal & Molyneux, 2005; Rosly, 2005; Khan & Ahmed, 2001). This is the first dynamic panel study that attempts to measure the maturity transformation risk and its determinants in Islamic banks, with regards to the IFSB and Basel III liquidity regulations. This study will provide insight into the synergies between liquidity creation and the maturity transformation risk of Islamic banks, such as the structure and variations of product portfolios (Lepetit, Nys, Rous, & Tarazi, 2008; Behr, Kamp, Memmel, & Pfingsten, 2007; Acharya, Hasan, & Saunders, 2006), capital structure or size (Koziol & Lawrenz, 2009; Diamond & Rajan, 2000), as well as the macroeconomic factors, by analyzing the structure and development of Islamic financial institutions and their refinancing sources (Dinger & Von Hagen, 2009).

1.3 Research Objectives

Previous studies on the determinants of liquidity transformation have focused primarily on the conventional banking system. Although Islamic banking and finance has shown phenomenal growth in recent years, it has received very little academic attention and less still from policy makers. This substantial growth calls for more intensive risk management practices and policies at all levels. Most of the existing literature has focused on the efficiency and stability of Islamic banks. However, an important gap exists in the empirical literature on how Islamic banks perform their liquidity transformation function. Moreover, the lack of literature which explains the relationship between maturity transformation of Islamic banks and their financial performance and stability is also a key motivator for our study.

This study aims to offer managers, investors, policymakers and regulators of Islamic financial institutions a better understanding about the factors that influence the maturity transformation function of the Islamic banking sector. It also hopes to fill the gap in the literature of the new IFSB liquidity regulatory requirements, and its relationship with the performance and stability of Islamic banks. The study's objectives are as follows:

1. To evaluate the influence of various factors in explaining the maturity transformation function of Islamic banks.
2. To evaluate the relationship of maturity transformation risk with the financial performance of Islamic banks.
3. To investigate the impact of maturity transformation risk on the financial stability of the Islamic banking sector.

1.4 Research Questions

This study attempts to address the following questions:

1) What are the factors that significantly influence the maturity transformation risk in the Islamic banking sector?
2) How is maturity transformation risk associated with the financial performance of Islamic banks?

3) Does the inclusion of net stable funding ratio contribute towards the improved stability of Islamic banks?

1.5 Significance and Rationale of the Study

The importance of the banking system is not only restricted to the economic development of a country, but its scope also extends to the stability and health of the overall financial system and environment (Halling & Hayden, 2006). However, due to some anomalies in the conventional banking system, banking crises have begun occurring more frequently with increased severity in recent times[2]. This augmented frequency of crises calls for an evaluation of risk management practices and policies at all levels, including individual banks, their regulators and financial sector policy makers. Liquidity risk presents a challenge for today's banks (Comptroller of the Currency, 2012). A bank with a sufficient capital, strong earnings and good asset quality may be unsuccessful if it does not retain sufficient liquidity (Crowe, 2009). The recent 2007-08 global financial crisis has not only demonstrated the failings of the established "Western" financial system, but has also amplified the consideration on a parallel neonatal financial system, the Islamic banking system, as some researchers have noted, the latter demonstrated a superior performance during the financial crisis (Hasan & Dridi, 2011).

In principle, Islamic finance is significantly different from conventional finance. The guidelines for Islamic finance stem from *Shari'ah law*; the unique and global legislation for Muslims with the *Quran, Hadith* (Sunnah), *Ijma* (consensus) *and Qiyas* (deduction of juridical principles from Quran and Sunnah) as its main sources. *Shari'ah* compliant financing is not permitted to charge *Riba* (interest payments), as only physical commodities and services are assumed to hold a value. *Gharar* (uncertainty), or *Mayser* (speculation or gambling) and all transactions that involve trading illegitimate goods and services, like weapons, drugs, and alcohol, are forbidden. The Islamic banking system is based on the principle of risk sharing (profit and loss). This applies to both financing and deposits. Islamic banking posits that all transactions must involve tangible assets (Iqbal & Mirakhor, 2011; Hassan & Lewis, 2009).

[2] Asian Banking Crisis 1997, the Collapse of Long-Term Capital Management 1998, the Russian Financial Crises 1998, and the US Sub-prime mortgage crisis, which led to the 2008 Global Financial Crisis.

These principals require clear variances in bank financing and liabilities arrangements. Due to these difference, we argue that both financial systems behave differently in managing their risks. However, there is limited research on the functions and performance of Islamic banks.

Previous studies have attempted to explain the relationship between bank liquidity and financial performance and stability (Bhattacharya & Gale, 1985; Waldo, 1985; Diamond & Dybvig, 1983; Bryant, 1980). These studies have found that a mismatch of maturities between assets and liabilities put banks in an intrinsic unstable condition by exposing them to the likelihood of panic-based bank runs. Some recent studies have also analyzed the impact of banks' choices of liquid assets (Acharya & Viswanathan, 2011), and banks' fear of fire sales (Diamond & Rajan, 2011), on the stability of financial institutions. However, most of these studies have focused on the conventional banking system. To the best of our knowledge, no prior study has addressed this issue in relation to the Islamic banking system. Given the phenomenal growth and the increasing importance of Islamic banking in the last decade, there is a need to understand how different banks' specific and external factors influence the liquidity creation of Islamic banks. More specifically, we empirically investigate the influence of Sharia regulations (that is, Islamic laws/principles) on various determinants, which affect maturity transformation risk, in Islamic banking.

Further, the management of banks varies in their policies in dealing and monitoring the risks and objectives linked with their operations, and thus the financial performance of each bank also varies. This study therefore investigates the linkage between transformation risk and profitability at the bank level.

Additionally, this study investigates the association between maturity transformation risk and stability in Islamic banks. We argue that investigating this association is vital because external factors may have severe implications on the stability of financial institutions (Turk-Ariss, 2010), particularly Islamic banks.

To achieve the research objectives, we use a sample of 468 bank-year observations of 55 full-fledged retail Islamic banks from 11 countries, which represents about 83 percent of the International Participatory Banks assets (Ernst & Young, 2017) and 52 percent of the global Islamic Banking assets (IFSB, 2017) at the end of 2015. The sample size is restricted because

of the non-availability of granular data from publically available banks' annual reports, which is required to measure the maturity transformation risk in Islamic banks. Moreover, we could not include banks from Iran in our data sample (which constitutes 34 percent of global Islamic banking assets (IFSB, 2017)), as the published annual reports are not available in English language, which precludes the risk measurement for these banks. This study employed state of the art two-step system Generalized Method of Moments dynamic panel data estimation technique to determine the factors influencing the maturity transformation risk as well as its relationship with profitability and stability of Islamic banks.

1.6 Structure of the Thesis

The thesis is organized as follows. Chapter 2 reviews the relevant literature, including the factors which influence the banks' maturity transformation risk, the measures of maturity transformation risk, and the causal relationship between the maturity transformation risk and bank profitability and stability. Chapter 3 decribes the research methodology and data used in this study. Chapter 4 presents and discusses the empirical results from dynamic panel data estimation and a series of robustness tests. Chapter 5 summarizes the major findings of the study, discusses the policy implications and limitations, and outlines possible directions for future research.

Chapter 2

Literature Review

2.1 Background

In the framework of risk and maturity transformation function of financial intermediaries, the latter undertakes the tasks of liquidity creation and insurance for inter-temporal smoothing of income and the consumption of economic agents (Diamond & Dybvig, 1983). Banks create liquidity through pooling of deposits, in which a certain proportion is the liquidity reserves while the rest is used for profitable illiquid investments (Acharya et al., 2006; Kashyap, Rajan, & Stein, 2002; Diamond & Dybvig, 1983; Bryant, 1980). However, the liquidity creation function of the bank, through investing in long-term illiquid assets, renders them intrinsically vulnerable to maturity transformation risk (Diamond & Dybvig, 1983). More commonly, with increased liquidity creation, banks reduce their ability to meet unexpected liquidity requirements of their borrowers and depositors. This is because illiquid assets are difficult to be monetized, especially when the economy is facing liquidity pressures or crises (Calomiris & Kahn, 1991; Diamond & Rajan, 2001).

In relevance to this study's research objectives, the following sections expand the previous theoretical and empirical literature on maturity transformation risk factors, bank profitability and stability. Section 2.2 reveals the theories linking maturity transformation risk and its associated factors. Section 2.3 discusses the empirical evidence on the influence of various factors in explaining the banks' maturity transformation risk. Section 2.4 reviews the previous empirical studies on the causal relationship between maturity transformation risk and banks' financial performance, followed by previous studies on maturity transformation risk and bank stability, outlined in Section 2.5. The chapter concludes with discussion on the main studies on the various measures of banks' maturity transformation risks.

2.2 Theoretical Features of Maturity Transformation Risk and its Determinants

Liquidity transformation has been extensively studied (Berger & Bouwman, 2009; Kashyap et al., 2002; Holmström & Tirole, 1998; Bhattacharya & Thakor, 1993). However, these studies focus mainly on quantifying the extent of liquidity created in the banking sector, and their exposure to maturity transformation risk. Recently, some developments have been made in investigating the factors which affect the banks' liquidity creation function (Vodová, 2011; Fungáčová, Weill, & Zhou, 2010; Shen, Chen, Kao, & Yeh, 2009) and the relationship with maturity transformation risk (Angora & Roulet, 2011). However, most of these studies are based on the conventional banking model. Using findings from previous literature, this study investigates the relevant determinants of maturity transformation risk in the Islamic banking system. The following section provides insight into the various bank-level and macroeconomic variables that are likely to influence bank exposure to maturity transformation risks.

2.2.1 Bank Capital

Previous theoretical literature has divided the effect of bank capital on maturity transformation risk in two broad categories. One set of literature explains that with an increase in equity capital, banks tend to either invest less in long-term illiquid assets or reduce their holding of short-term liquid liabilities, thereby mitigating their exposure to liquidity transformation risks. Diamond and Rajan (2005) argue that a nominal intermediary service levy is charged to depositors to lend their deposits. However, the mismatch of this fee with the repayment capability of risky borrowers, will provoke depositors to withdraw their funds, promoting "*financial fragility,"* which, in extreme cases, may lead to run on the bank, causing severe liquidity problems, both for the banks and the financial sector as a whole. Gorton and Winton (2000) similarly explain the *"crowding-out effect,"* where banks prefer to meet higher capital requirements by replacing depositors' funds with their capital accounts. Nevertheless, these investments are susceptible to financial uncertainty and cyclical variations, which are not insured and difficult to withdraw when required, ensuing a decrease in liquidity creation. The impediment of holding the amount of assets by banks for issuing deposits, with respect to higher capital requirements, has also been studied by Heuvel (2002). The author claims that such regulations can be excessively costly to banks. Both the *"financial fragility"* theory

and *"crowding-out effect"* demonstrate that higher capital buffer may reduce a bank's liquidity transformation risks.

On the contrary, under the "*risk absorption"* theory, Allen and Gale (2004) assert that higher capital requirements can increase banks incentive for more liquidity creation. The authors reveal that increased liquidity creation exposes banks to higher degrees of risk, as losses increase with increased levels of illiquid assets to satisfy customers' liquidity demands. This activity is directly associated with the risk transformation role of the financial intermediaries (Al-Khouri, 2012). Furthermore, Besanko and Kanatas (1996) posit that a higher capital requirement may dilute insiders' ownership and increase outside equity that could lead to asset-substitution moral hazard problem of managers. Blum (1999) and Gennotte and Pyle (1991) have also made similar claims, suggesting that banks are more likely to take on greater risks with increased in capital requirements. Subsequently, the increased liquidity needs encourage banks to incur higher losses due to the disposal of illiquid assets at available market prices, rather than desired prices, to meet their customers' obligations. However, higher bank capital can absorb these losses and expand the risk-bearing capacity of financial intermediaries (Coval & Thakor, 2005; Repullo, 2004; Bhattacharya & Thakor, 1993). Thus, higher capital ratios allow banks to create more liquidity, as well as the extent of their exposure to maturity transformation risks, presenting a positive relationship between bank capital and transformation functions.

2.2.2 Non-Interest Income

Previous literature proposes that banks can benefit at large, through diversification (Boyd & Prescott, 1986; Diamond, 1984; Ramakrishnan & Thakor, 1984). Some studies also suggest that diversification benefits firms through product portfolio management or from activity diversification on the asset-side. On the liability-side, it generates economies of scope for the organization (Drucker & Puri, 2009; Gatev et al., 2009; Iskandar-Datta & McLaughlin, 2005; Kashyap et al., 2002). The seminal article by Boyd, Hanweck, and Pithyachariyakul (1981) laid the foundation for the relationship between non-interest income and bank risk. They argue that an increase in non-interest income can help banks to improve risk diversification, leading to higher degrees of stability. A number of empirical studies support this argument. Using a dataset of 249 listed banks and non-bank financial firms, from 1974 to 1981, Boyd and

Graham (1988) found that banks expanding into insurance companies significantly reduce their earnings volatility as well as the risk of bankruptcy. Similarly, using market based data from 1979 to 1986, Templeton and Severiens (1992), revealed that diversifying into other uncorrelated financial activities reduces banks' unsystematic risk. More recently, Köhler (2013) shows that non-interest income has a significant positive effect on the stability of small and retail oriented banks, as this increases their income structure diversification and limits their dependence on interest rate risks, as well as the maturity transformation function.

In contrast, DeYoung and Roland (2001) highlighted the large volatility of non-interest income in three ways. Firstly, income from traditional banking activities (that is, lending and borrowing), is more likely to be stable over time, as it involves high switching and information cost to either lenders or borrowers, to shift their financing relationship. However, returns from non-interest income activities may face larger variability, as they do not involve high switching and information costs, lowering the barriers for switching banks for such type of activities. Secondly, increased concentration on non-interest income activities give rise to additional fixed costs, hence increasing the operational leverage of banks. On the contrary, in a conventional lending relationship, the marginal costs incurred while creating additional loans is limited to interest expenses. Thirdly, banks find incentives to involve more in non-interest income activities, as they are not disciplined by regulators for capital requirements, suggesting a higher degree of financial leverage, consequently increasing their earnings volatility. Furthermore, Busch and Kick (2009) found that banks' risk-adjusted returns increase with increases in the portion of fee income activities, but retail banks that are heavily involved in non-interest income activities, have shown significantly more volatile returns, leading to increased bank risks. Altunbas, Manganelli, and Marques-Ibanez (2011) and Demirgüç-Kunt and Huizinga (2010b) presented similar results, using data from listed investment-oriented banks. Likewise, Brunnermeier, Dong, and Palia (2012) found evidence that banks involved more in non-core banking activities (such as trading and investment and venture capital activities) earnt higher non-interest income, contributing more towards systemic risk than those following traditional banking functions of deposit taking and lending. Their findings were consistent, even after categorizing non-interest income into trading income and investment banking, and venture capital income, where both components are approximately equal contributors to systemic risk.

2.2.3 Bank Profitability

In general, bank profitability explains the influence of increase in financial soundness on banks' risk bearing capacities and on their ability to create liquidity (Rauch, Steffen, Hackethal, & Tyrell, 2009; Shen et al., 2009). As a result, this increase in financial strength may enhance the banks' ability to take risks, which yields a positive relationship between bank profitability and transformation risk. Moreover, profitability can also account for the "too big to fail" philosophy of large banks (Demirgüç-Kunt & Huizinga, 2010a; Zhou, 2010). Large banks may be exposed to increased maturity transformation risk as they can create more liquidity, even in times of distress, in order to increase their profitability.

2.2.4 Bank Credit Risk

Classical microeconomic theories of banking support the view that credit risk is closely linked to liquidity transformation. Under the financial intermediation framework, Bryant (1980) and Diamond and Dybvig (1983) propose that a bank's asset and liability structures are closely linked, more specifically in terms of loan defaults and deposit withdrawals. Kashyap et al. (2002) and Holmström and Tirole (1998) reveal this asset-liability interaction goes beyond the banks' balance sheet business and also involves off-balance sheet lending and funding activities. Diamond and Rajan (2005) propose that banks lend from the money they obtain from unskilled depositors, with the promise to pay this money back to the depositors on demand. This become problematic when a large number of economic projects, funded with loans, generate insufficient returns, or the borrowers are unable to pay back the principle loan amounts and the bank cannot meet depositors' withdrawal requirements. Consequently, this decrease in assets encourages depositors to withdraw their funds, thereby forcing banks to call in all loans which ultimately leads to a reduction of aggregate liquidity in the market. Hence, higher credit risk restricts banks' liquidity creation function.

More recently, many studies have examined, mainly from a theoretical perspective, the relationship between credit risk and maturity transformation risk and how this interaction influences bank stability (Acharya & Mora, 2015; Imbierowicz & Rauch, 2014; Gorton & Metrick, 2012; He & Xiong, 2012; Acharya & Viswanathan, 2011; Gatev et al., 2009). Acharya and Viswanathan (2011) reveal that, in normal times, more emphasis on short-term market

debt might lead to severe asset shocks and a rapid drying up of liquidity in economic downturn. As their primary function, financial firms raise debt that has to be rolled-over constantly, which is used to finance assets. They found that, during stressful conditions, when asset prices deteriorate, banks find it much more difficult to roll over the debt. Therefore, banks with higher debt face more severe liquidity risk that may lead to a run on banks.

Similarly, expanding Diamond and Dybvig's (1983) work, He and Xiong (2012) also highlight the debt rollover risk. He and Xiong's study assumes that a bank has debt maturities spread over time, with various creditors and that these creditors are exposed to an intrinsic risk of bank failure during the next contract period if other future maturing creditors choose not to rollover their debt contracts. This may result in a run on lenders and banks being unable to rollover their debts, leading to liquidity dry up in the market. Consequently, a lack of funding sources provides banks with incentives to hold more liquid assets and restrict them to perform their normal liquidity creation function, in order to fulfil depositors' demands.

Gordon and Metrick (2012) have examined the relationship between liquidity and credit risk in securitized banking. The empirical results show a substantial increase in refinancing rates and funding haircuts in wholesale market caused perceived credit risks in the form of subprime loans. Although investors exhibit asymmetric information regarding the actual subprime risks held by banks, the fear of decrease in their investment value, which caused non-availability of short-term market funding resulted in severe liquidity problems for the banks in the recent global financial crisis.

2.2.5 Bank Market Power

Bank market power may influence the availability of funding (Petersen & Rajan, 1995) and the split of loan portfolio (Berger, Miller, Petersen, Rajan, & Stein, 2005). Previous literature has hypothesized the impact of bank competition on liquidity creation in two opposing ways. The first theory proposes that increased competition increases the fragility of banks by reducing bank profits, which normally serves as a "buffer" against shocks during stress conditions. This provides a reason for the banks to lessen liquidity creation by restraining both the volume of loans granted, and the volume of deposits accepted, to mitigate the bank's risk. Horvath, Seidler, and Weill (2016) argue that under this *"fragility-channel"* hypothesis, an increase in

bank competition should lead to a decrease in liquidity creation. Petersen and Rajan (1995) support this view, claiming that increased competition reduces credit supply, as banks are less likely to grant loans to borrowers that are not in previously established relationship with them, in a competitive market. The idea is that decreased market power reduces incentives for banks to establish long-term relationships with new borrowers that may create an abnormal credit demand in the future.

The second viewpoint relates to the influence of competition on bank pricing policies and suggests that increased competition leads to deteriorating lending prices and escalating deposit rates, thereby increasing the demand for both loans and deposits. Several studies provide empirical support for a link between competition and low lending rates (Love & Pería, 2015; Carbo-Valverde, Rodriguez-Fernandez, & Udell, 2009). Enhanced competition stimulates demand for loans by alleviating financing obstacles. Beck, Demirgüç-Kunt, and Maksimovic (2004) provide empirical support for this argument in their finding that increased bank concentration increases financing obstacles in general, while Hainz, Weill, and Godlewski (2013) show that increased concentration is associated with higher collateral requirements. Berger and Bouwman (2009) explain that banks with greater market power may enhance their liquidity creation by making more loans and attracting more funds, either from the depositors or from the wholesale market. This suggests a positive link between competition and liquidity creation that may lead to increased exposure to transformation risks.

2.2.6 Bank Size

Generally, bank size is classified in terms of net total assets. In line with the argument of 'too big to fail' philosophy, the implicit regulator guarantee decreases banks' funding cost, which enables them to invest in more risky assets (Iannotta, Nocera, & Sironi, 2007). Tesfaye (2012) highlighted regulators' protection of large banks as the cause of moral hazard problems. This also reduces the incentive to hold more liquid assets for larger banks and allows difference in liquidity creation among the banks, relative to their size. The literature provides both positive and negative relationship between bank size and liquidity creation. As Delechat, Arbelaez, Muthoora, and Vtyurina (2012), reveal, liquidity increases with bank size, however, after a threshold, their study shows a marginal decrease in liquidity holdings, with an increase in

bank size, denoting a non-linear relationship between them. In addition, during stress conditions, larger banks perform more liquidity creation, hence exposing to higher losses due to the sale of illiquid assets. Furthermore, Rauch et al. (2009) and Berger and Bouwman (2009) note that smaller banks are less involved in liquidity creation, as they are focused mainly on transformation activities and intermediation processes.

These findings contradict some of the previous studies, such as Audretsch and Elston (2002), who found that smaller banks possess relatively more liquid assets and less liquidity constraints. Similarly, Kashyap et al. (2002) also revealed a strong influence of bank size on liquidity creation and concluded that as smaller banks face constraints in accessing capital markets, they tend to maintain higher levels of liquidity. Similarly, Shen et al. (2009) also found a nonlinear relationship between bank size and liquidity risk. Large banks follow the 'too big to fail argument' and find incentives to perform their liquidity creation function more aggressively; hence, they are exposed to higher maturity transformation risks. However, the negative sign on the coefficient of size square revealed that in larger banks (over a certain level), this size effect becomes negative to liquidity creation. Similarly, Fungáčová et al. (2010) examined the size effect on the relationship between bank capital and liquidity creation in emerging markets, and revealed that small banks with higher capital create less liquidity. However, they could not find any significant effect of bank capital on liquidity creation in large banks. While investigating the effect of monetary policy on liquidity creation, Berger and Bouwman (2010) found that restrictive monetary policies negatively impact upon the liquidity creation of small banks only.

2.2.7 GDP

GDP indicates the financial wellbeing of any country. In the past, many studies have established the impact of macroeconomic factors on bank liquidity. For example, Gavin and Hausmann (1996) determined macroeconomic instability as one of the major causes of bank failures. The authors revealed that the impact of negative shocks increases the inability of borrowers to repay their obligations, giving rise to non-performing loans, which hampers the bank's performance and ultimately causes financial instability. Determining the impact of economic downturn, Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001) argue that the degree of loan defaults is even higher during periods of recession. Depositors perceive

high solvency risk during recession periods, which triggers unexpected large deposit withdrawals. This leads to bank runs, causing liquidity risks and ultimately bank insolvency. Similar findings have been revealed by Shen et al. (2009). Analyzing the cyclical effect on bank liquidity preferences, Aspachs, Nier, and Tiesset (2005) propose that banks prioritize liquidity during economic uncertainties when they have less opportunities to increase their lending assets. Painceira (2010) suggests that banks' incentive to hold more liquid assets decreases during periods of economic upswings; however, banks are likely to maintain high levels of liquidity during stress conditions.

2.3 Empirical Literature on Determinants of Maturity Transformation Risk

Very few studies have focused empirically on bank specific, industry specific and macroeconomic determinants of funding liquidity risk. Rauch et al. (2009) identifies the determinants of liquidity risk and attempts to ascertain the elements of liquidity creation. The authors highlighted monetary policies and macroeconomic variables as the most significant determinants of banks' liquidity creation. Their results illustrate that bank specific variables, such as financial performance and size, have no significant relationship on the maturity transformation function.

Following Saunders and Cornett (2007), Shen et al. (2009) employs funding gap ratio as a liquidity risk measure to investigate the factors causing bank liquidity risk.[3] They apply instrumental variable techniques on unbalanced panel bank data from 12 advanced economies, for the period of 1994 – 2006. They found components of liquid assets and dependence on external funding as the main causes of funding liquidity risk. The study also found a non-linear relationship among liquidity and bank size. Additionally, macroeconomic variables such as GDP and inflation, as well as supervisory and regulatory factors, have been shown to have a significant effect on banks' liquidity risks.

Using a large dataset of 781 commercial banks, from the US and Europe, over the period of 2000 – 2008, Angora and Roulet (2011) found that banks' maturity transformation risk reduces with an increased concentration of potentially securitizable loan portfolios. The

[3] (Saunders & Cornett, 2007) indicated that banks can measure liquidity risk exposure by determining their financing gap. The financing gap is defined as the difference between a bank's average loans and average core deposits.

authors also find that banks which rely more on short-term market funding tend to have higher maturity transformation risks. The study utilizes the inverse of net stable funding ratio (I_NSFR) and net stable funding difference (NSFD), as measures of maturity transformation risk. Among other bank-specific and macroeconomic factors, the authors found that bank capital, size, market power and loan loss provisions are significant in reducing the banks' maturity transformation risk, whereas, economic growth and interest rate spreads are significant in explaining increased maturity transformation risks, in the sample banks.

Munteanu (2012) used country specific data and multiple regression model to identify the determinants that influence retail banks' liquidity in Romania. The author used two different liquidity measures,[4] and divided the dataset into pre-crisis and during the crisis.[5] The findings revealed these two measures have different policy implications in the pre-crisis and during crisis periods. Further, macroeconomic factors, such as unemployment and inflation, were found to be significant in explaining bank liquidity, which suggests the need for continuous reporting of aggregate risks. The authors also reveal that the Z-score (a bank's stability indicator) has a significant effect on bank liquidity during the crisis period.

Bonfim and Kim (2012) also explained that the relationship between liquidity and bank size, efficiency and loan to deposit ratio depends on the type of liquidity risk measure used. They found strong empirical evidence of peer effect in banks' risk taking. In addition, the banks with greater customer lending tend to have higher loan to deposit ratios and usually maintain minimum liquidity ratios.

Horvath, Seidler, and Weill (2012) examined the potential impact of tighter capital requirements on banks' liquidity creation in the Czech Republic and found Basel III capital requirements can reduce liquidity creation. They note that increased liquidity creation can trigger bank insolvency. Using an exhaustive data sample of 2000 to 2010, the authors performed Granger – causality tests in a dynamic GMM panel estimator framework and revealed that capital is negatively associated with liquidity creation in their sample banks

[4] The two liquidity measures are L1- net loans/total assets and L2 – liquid assets/deposits and short-term funding.

[5] (Munteanu, 2012) used the period from 2008 – 2010 as the crisis period.

(mainly small banks). In short, they found that well capitalized banks are less involved in their maturity transformation function.

Few studies have also attempted to identify the factors that influence the funding liquidity risk in Islamic banking sector. Alman and Oehler (2012) investigated the liquidity transformation factors in Islamic banks. The study used a cross-country data set of 36 Islamic and 42 conventional banks over the period of 2000 – 2010. The results revealed that liquidity transformation is negatively associated with the regulation of Islamic banks. The authors used the liquidity transformation gap (LTG) to measure bank liquidity transformation as the dependant variable, and found that the bank risk taking, solvency and interbank demands are negatively associated with the liquidity transformation of Islamic banks. In addition, larger Islamic banks create more liquidity. One of the downside of using LTG is that it does not classify assets and liabilities according to product categories. In addition, such measures do not indicate the extent of liquidity creation beyond which it offsets the advantage of performing this function.

In a comparative study, Muharam and Kurnia (2012) applied the multiple linear regression model to investigate the influence of bank capital, profitability, net interest margin, liquidity gaps, and risky liquid assets, on liquidity risk in the Indonesian banking sector. Their study utilized a sample of 3 conventional and 3 Islamic banks in Indonesia, over the period of 2007 – 2011. The findings showed that capitalization and ROE are negatively associated, while liquidity gaps are positively associated with bank liquidity, in the case of conventional banks. The results also found a significant and negative influence in regards to ROA and a positive significant impact for ROE and NIM on bank liquidity, in the case of Islamic banks.

To determine how the Islamic banking sector in Malaysia manages its liquidity, in response to variations in different idiosyncratic and macroeconomic factors, Mohamad, Mohamad, and Samsudin (2013) applied dynamic panel data estimation technique to 17 Islamic banks from 1994 to 2009. The empirical results show that Islamic banks are liquidity providers in times of economic upswings and that the liquidity of Islamic banks deteriorates with an increase in financing. The findings also reveal a non-linear (U – shaped) relationship between bank size and liquidity, during the study period.

Ben Jedidia and Hamza (2015) examined the relationship between various bank-specific and macroeconomic factors, and the liquidity risk in Islamic banking. The study used a sample of 60 Islamic banks in the Middle East and North African (MENA) countries, over the period of 2004 to 2012. The authors reveal that banks profitability is a significant determinant of increased liquidity risk in the sample banks. Whereas, the liquidity risk is significantly reduced with an increase in bank capitalization and investment ratio. GDP growth is insignificant in explaining Islamic banks' liquidity risk.

Ghenimi and Omri (2015) compared the liquidity risk determinants of conventional and Islamic banks in the Gulf countries. Using a sample of 33 conventional and 11 Islamic banks from 2006 to 2013, their findings show that return on assets and non-performing loans are the most common factors that significantly increase liquidity risks, in both Islamic and conventional banking systems. Bank size, return on equity, capital adequacy, and inflation were found to be significant in reducing the liquidity risk, in both Islamic and conventional banks.

Using a panel dataset of 42 Islamic banks, from 15 Arab countries, over the period of 2007 and 2014, Alzoubi (2017) found a negative correlation between cash ratio and liquidity risk. The author also suggested that bank size, solvency and investment ratio are the significant factors in reducing the liquidity risk of sample banks. Whereas, the researcher found a strong positive influence of bank profitability and poor asset quality on liquidity risk, during the study period. In addition, the findings established a weak non-linear relationship between bank size and liquidity risk. Table 2.1 summarizes the empirical literature on the factors influencing banks' maturity transformation risks.

Table 2.1. Summary of Empirical Literature on Determinants of Maturity Transformation Risk

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Findings
Rauch et al. (2009)	457 German Saving banks	1997 – 2006	Determinants of banks' maturity transformation function.	Multivariate dynamic panel regression	Interest rates and unemployment are significantly and negatively associated with the banks' liquidity creation. Whereas, bank-specific factors, such as size and financial performance, have no significant influence on their maturity transformation function.
Shen et al. (2009)	12 developed countries	1994 – 2006	Causes of liquidity risk and relationship between liquidity risk and bank performance	Two-stage least squares (2SLS)	Risky liquid assets, less-risky liquid assets, external funding dependence, supervisory and regulatory factors, GDP and inflation are the significant factors causing liquidity risk. Bank size has a non-linear relationship with liquidity risk. Moreover, banks' financial performance deteriorates with an increase in the liquidity risk.
Angora and Roulet (2011)	781 commercial banks from the US and European region	2000 – 2008	Determinants of maturity transformation risk.	Regression – Fixed effects (FE)	Banks that rely more on short-term market funding tend to have higher maturity transformation risks. Whereas, concentration in potentially securitizable loan portfolios significantly reduce maturity transformation risk. Additionally, bank capital, size, market power and loan loss provisions are significant in reducing banks' maturity transformation risk, whereas, economic growth and interest rate spreads are significant in explaining the increased maturity transformation risk.
Munteanu (2012)	27 Romanian banks	2002 – 2010	Determinants of retail banks' liquidity	Multiple regression model	The two liquidity measures used have different policy implications in the pre-crisis and during crisis period. Further, macroeconomic factors, such as unemployment and inflation, are found to be significant in explaining bank liquidity. Additionally, Z-score (bank's stability indicator) has a significant effect on bank liquidity during the crisis period.
Bonfim and Kim (2012)	3,500 banks from 45 countries of the US and European region	2002 – 2009	Determinants of bank liquidity risk and the effect of externalities (herding behaviour).	Regression – Fixed effects (FE)	Peer effect is significantly associated with bank's risk taking behaviour, which calls for macro-prudential liquidity risk management approach. In addition, bank size, net interest margin, return on assets, cost efficiency, net loans to total assets, and loans to customer deposits, are significant factors influencing banks' net stable funding ratio. Moreover, banks with greater customer lending tend to have higher loan to deposit ratios and usually maintain minimum liquidity ratios.

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Findings
Horvath et al. (2012)	31 banks from the Czech Republic	2000 – 2010	Relationship between bank capital and liquidity creation	Generalized method of moments (GMM)	Bank capital is negatively associated with liquidity creation, i.e. well capitalized banks are less involved in their maturity transformation function. In addition, bank size, non-performing loans, stability and unemployment, are negatively associated with banks' maturity transformation function.
Alman and Oehler (2012)	36 Islamic and 42 conventional banks from the Persian Gulf and states of the GCC region	2000 – 2007	Determinants of liquidity transformation in a dual banking system	Regression – Fixed effects (FE)	Bank risk, solvency and interbank demand are significantly and negatively associated with liquidity transformation in Islamic banks. In addition, larger Islamic banks create more liquidity.
Muharam and Kurnia (2012)	3 Islamic and 3 conventional banks from Indonesia	2007 – 2011	Factors influencing liquidity risk in a dual banking system	Regression – Ordinary least squares (OLS)	Liquidity risk of Islamic bank increases with an increase in return on assets, whereas, return on equity and net interest margin are significant factors for improving bank liquidity, in terms of cash to asset ratio.
Mohamad et al. (2013)	17 Islamic banks from Malaysia	1994 – 2009	Determinants of liquidity risk in Islamic banks	Difference-GMM and System-GMM	Islamic banks are liquidity providers in times of economic upswings and the liquidity of Islamic banks deteriorates with an increase in financing. Moreover, bank size shows a non-linear (U – shaped) relationship with liquidity.
Ben Jedidia and Hamza (2015)	60 Islamic banks in the MENA region	2004 – 2012	Determinants of liquidity risk in Islamic banks	System GMM	Profitability is positively related to the liquidity risk of Islamic banks. Bank capitalization and investment ratio are the significant contributors in lowering the liquidity risk in sample banks. Whereas, economic growth has no significant influence on Islamic banks' liquidity risk.
Ghenimi and Omri (2015)	11 Islamic and 33 conventional banks from Gulf countries	2006 – 2013	Factors influencing liquidity risk in a dual banking system	OLS, FE and RE	Bank capitalization, size, return on equity, net interest margin, and inflation, lower liquidity risk in Islamic banks. Whereas, returns on assets and non-performing loans show a significant positive relationship with the liquidity risk of both Islamic and conventional banks.
Alzoubi (2017)	42 Islamic banks from 15 Arab countries	2007 – 2017	Determinants of liquidity risk in Islamic banks	Regression – Ordinary least squares (OLS)	Cash ratio, size, capital adequacy and investment ratio are significant factors in reducing the liquidity risk in Islamic banks. Return on assets and poor asset quality are positively correlated with bank liquidity risk. In addition, the study finds a weak non-linear relationship between bank size and liquidity risk.

2.4 Empirical Literature on Maturity Transformation risk and Bank Performance

Previous empirical literature provides mixed evidence on the relationship between funding liquidity risk and bank performance. One strand of literature supports the argument that banks will incur more cost in tying up of additional resources in liquid assets and will result in a decrease in profitability (Curak, Poposki, & Pepur, 2012; Naceur & Kandil, 2009; Li, 2007; Demirguc, Laeven, & Levine, 2003; Guru, Staunton, & Balashanmugam, 2002). The other strand of literature argues that with less liquid assets, banks become vulnerable to a classic run on bank or solvency risk and suggests a positive relationship between liquidity and bank performance (Olagunju, David, & Samuel, 2012; Sufian & Habibullah, 2009; Kosmidou, 2008; Bourke, 1989). In addition, some empirical literature provides evidence of mixed or no relationship between liquidity and profitability (Ariffin, 2012; Ommeren, 2011; Shen et al., 2009; Pasiouras & Kosmidou, 2007; Athanasoglou, Delis, & Staikouras, 2006).

Molyneux and Thornton (1992) replicated and extended their study on the seminal works of Short (1979) and Bourke (1989). The authors examine the determinants of bank performance across 18 European countries, over the period of 1986 – 1989. They use the ratio of liquid assets to total asset as a proxy for liquidity and found a negative and significant relationship with bank profitability, measured as return on assets (ROA). Their results imply that more liquid assets held by a bank increases its intermediation cost and reduces its capacity to generate profits. Since holding more liquid assets reduces the maturity transformation risk (Li, 2007), this suggests a positive correlation between bank earnings and their degree of exposure to maturity transformation risk.

Guru et al. (2002) analyze the Malaysian banking industry between 1985 and 1998 and investigate the factors that determine a successful commercial bank. Their results also provide evidence of a negative relationship between liquidity and bank profitability. Demirguc et al. (2003) analyzed a sample of commercial banks from 72 different countries, over the period of 1995 – 1999. They applied the generalized least square technique to assess the effect of bank regulations, concentration, inflation and national institutions on bank performance and found a negative relationship between liquidity and bank profitability. Li

(2007) investigates the impact of bank specific characteristics and banking environment on financial performance of the UK banking industry, over the period of 1996 – 2006 and found a weak negative relationship between bank liquidity and profitability.

Using the Generalized Method of Moments technique, Naceur and Kandil (2009) examined the impact of capital requirements on Egyptian banks' stability and performance between 1989 and 2004. The authors' results show a positive and statistically significant relationship between liquidity risk and profitability of domestic banks. Consistent with these results, Alexiou and Sofoklis (2009) also found a positive relationship between liquidity risk and bank profitability. The authors examine the critical factors that affect the profitability of six major commercial banks of Greece over the period of 2000 – 2007. Their findings suggest that an increase in liquidity, as measured by the ratio of loans to customer deposit, result in decline in bank profitability. In addition, Curak et al. (2012) examined the bank-specific, industry specific and macroeconomic determinants of bank profitability in the Macedonian banking sector. They utilized the two-step system GMM technique to quantify various factors affecting profitability, based on of a dataset of 16 banks, over the period of 2005 to 2010. The authors use the ratio of loan to deposit as a proxy of liquidity risk and found a positive relationship with bank profitability. They suggest that banks with a higher loan to deposit ratio utilize their resources in higher yield assets which results in increased profitability.

On the contrary, Bourke (1989) reviewed the performance of banks in twelve countries in Europe, America and Australia over a period of ten years (from 1972 to 1981). The author investigated internal and external determinants of profitability in a sample of 90 banks from these territories and found the ratio of liquid assets to total assets, as a proxy of liquidity, was statistically significant and positively related to bank performance, as measured by ROA. The results imply that banks with less maturity transformation risk, by holding more liquid assets, perform better.

Using an unbalanced pooled data set of Greek commercial banks over the period of 1990 to 2002, Kosmidou (2008) shows a statistically significant and positive relationship between bank liquidity and performance. Similarly, Olagunju et al. (2012) comes to the similar conclusions. The authors conducted a survey on the liquidity management and bank performance in Nigerian banks. Using unstructured questionnaires and descriptive statistics,

they found a positive and significant relationship between banks' preference of holding liquid assets and profitability. Additionally, Sufian and Habibullah (2009) analyzed the banking industry in China between 2000 and 2005 to identify the firm-specific and macroeconomic determinants of commercial bank profitability. The authors found that more liquid state-owned commercial banks showed higher profitability. They argued that one possible reason for this relationship is that a bank requires more liquidity to meet accelerating screening and monitoring costs with an increase in the portion of loans in the bank's asset portfolio.

Several studies find both negative and positive effects related to maturity transformation risk and bank performance. Kosmidou, Tanna, and Pasiouras (2005) analyzed the internal and external determinants of profitability in UK commercial banks over the period of 1995 to 2002. The authors had results were inconclusive, as the ratio of liquid assets to customers plus short-term funding, a proxy of liquidity, was statistically significant and positively related to return on average assets, but negatively related to net interest income. In their study, Pasiouras and Kosmidou (2007) examined the effects of bank-specific characteristics, financial market structure and macroeconomic conditions, on the performance of domestic and foreign commercial banks in 15 European countries between 1995 and 2001. The authors found that the ratio of net loans to customers and short-term funding is significant and positively related to return on average assets of domestic banks, whereas in case of foreign banks, the relationship is significant but negatively related. Furthermore, Ariffin (2012) studied the relationship between liquidity risk and profitability in the Malaysian Islamic banking system. The results show a positive correlation between liquidity risk and bank profitability, based on return on assets. However, the study found a negative correlation between liquidity risk and return on equity. Similarly, Shen et al. (2009) investigated the causes of liquidity risk and determinants of bank performance in 12 advanced economies, over the period of 1994 – 2006. The authors used financing gap ratio as a proxy of liquidity risk and found a statistically significant and positive relationship with banks' net interest margin in a market-based financial system. However, a negative and significant relationship was established between liquidity risk and return on assets, as well as return on equity, in the sample banks. The results also showed that liquidity risk had no effect on bank performance in the bank-based financial system. The authors concluded that liquidity risk is endogenous to bank performance.

Some authors find no relationship between liquidity and financial performance. Athanasoglou et al. (2006) studied the factors effecting profitability in the banking system of South East Europe between 1998 and 2002. Their findings revealed that loans to total assets, as a measure of bank liquidity, had no significant effect on either return on asset or return on equity, proxies of bank performance. Ommeren (2011) came to similar conclusions. In his study on the determinants of profitability in 354 European banks over the period from 2000 to 2009, the author found a negative but statistically insignificant relationship between bank liquidity and profitability.

Few studies have also explicitly examined the influence of liquidity on bank profitability, in the case of Islamic banks. Previous literature provides mixed evidence on the liquidity – profitability relationship and depends mainly on the liquidity measure used in the study. Haron (2004) examined the influence of various internal and external factors on the profitability of 14 Islamic banks. The author found that, in the sample, financing to deposit ratio, as a measure of bank liquidity, is significant in explaining increased profitability. In the same vein, Srairi (2009) examined the influence of several factors at bank, industry and country level, on the profitability of Islamic banks in GCC region. The study found a significant negative relationship between liquidity and Islamic banks' profitability. The author argued that the possible reason for this negative association could be the high opportunity costs associated with holding excessive liquid assets. Asutay and Izhar's (2007) study also revealed a significant negative relationship between liquidity and Islamic bank profitability. Rachdi and Mokni (2014) analyzed the factors affecting conventional and Islamic bank profitability in the MENA region, using a sample of 15 conventional and 15 Islamic banks over the period of 2002 to 2009. The authors employed a generalized method of moment estimation technique and found that liquidity risk and ownership status are significant and positively associated with the profitability of Islamic banks, while bank capital is significant in determining conventional banks' profitability. In the case of Islamic banks, the results also reveal a negative management efficiency – profitability relationship. On the contrary, based on a sample of 16 Islamic banks in Malaysia, during 2005 and 2008, Wasiuzzaman and Tarmizi (2010) found a significant and positive influence of liquidity and management efficiency on Islamic banks' profitability. However, bank capital and asset quality were negatively associated with

profitability. Further, gross domestic product and inflation positively influenced Islamic banks' profitability during the study period.

Idris et al.'s (2011) study did not find any significant relationship between liquidity and profitability in 9 Malaysian Islamic banks, during the period of 2007 to 2009. More recently, Chowdhury and Rasid (2015) employed the ordinary least squares method to analyze 2013 annual data from 44 Islamic banks in the Asian and African region. Their results also showed no empirical evidence of association between liquidity and profitability in the sample Islamic banks. Mirzaei (2011) found mixed empirical evidence on the influence of liquidity on Islamic banks' profitability. Using an unbalanced dataset of 175 Islamic and conventional banks from 12 Middle Eastern countries over the period of 1999 to 2008, the authors found that the liquid assets ratio was significantly and negatively associated with the return on assets of Islamic banks, whereas the return on equity of Islamic banks showed significant improvement with an increase in liquid assets.

Based on the literature discussed, the findings regarding maturity transformation risk and bank profitability are mixed. For example, Molyneux and Thornton (1992) and Guru et al. (2002), reveal a negative and significant relationship between bank liquidity and profitability. Srairi (2009) and Rachdi and Mokni (2014) came to similar conclusions, when investigating the impact of liquidity on Islamic banks' profitability. In contrast, Bourke (1989) and Kosmidou (2008) found a significant positive relationship between liquidity and bank profits. Sufian and Habibullah (2009) also reveal a significant and positive relationship between liquidity and bank profitability. Similarly, Haron (2004) and Wasiuzzaman and Tarmizi (2010) reveal a significant positive relationship between liquidity and profitability of Islamic banks. In the case of conventional banks, Ommeren (2011) and Athanasoglou et al. (2006), and Chowdhury and Rasid (2015) and Idris et al. (2011), in the case of Islamic banks, did not show any empirical evidence of bank liquidity – profitability relationship. To the best of our knowledge, no study has examined the influence of IFSB's new liquidity measure (NSFR) on Islamic banks' profitability. Therefore, we can conclude that the impact of banks' liquidity transformation function on financial performance remains ambiguous and further research is required. Table 2.2 summarizes the empirical literature on the influence of maturity transformation risk on bank profitability.

Table 2.2. Summary of Empirical Studies on Maturity Transformation Risk and Bank Performance

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Finding
Molyneux and Thornton (1992)	18 European Countries	1986 – 1989	Determinants of bank profitability (net profit before tax, net profit after tax)	Regression - OLS	Banks' profitability is positively associated with high capital ratios and nominal interest rates. Moreover, government ownership shows significant and positive impact on profitability. For liquidity ratios, the study finds a weak inverse relationship with bank performance.
Bourke (1989)	America, Europe and Australia	1972 – 1981	Concentration, staff expense, liquidity, government ownership interest rate, market growth and inflation as determinants of banks profitability	Regression - OLS	Capital ratios, liquidity ratios and interest rates are positively related to profitability. While staff expense shows an inverse weak relationship with pre-tax return on assets.
Guru and Staunton (2002)	Malaysia	1985 – 1998	Determinants of a successful commercial bank	Regression – OLS	Loans to deposit ratio as a measure of liquidity is weak and negatively associated with bank profitability
Demirguc- Kunt et al. (2003)	72 countries	1995 – 1999	Bank regulations, concentration, inflation, and national institutions on bank net interest margins NIM	GLS – Random Effects	Bank liquidity measured as a ratio of liquid assets to total assets is statistically significant and negatively related to profitability
Kosmiduo, Tanna and Pasuouras (2005)	United Kingdom	1995 – 2002	Bank-specific, macroeconomic and market structure factors on banks' performance	Regression – Fixed Effects	Ratio of liquid assets to customer and short-term funding is statistically significant and positively related to return on assets and is negatively related to net interest margins.
Athanasoglou *et al*. (2006)	South Eastern European (SEE)	1998 – 2002	Determinants of bank profitability	Random Effects – Generalized Least Square	Loans to total asset as a measure of bank liquidity has no significant effect on bank performance measured as return on assets and return on equity
Li (2007)	United Kingdom	1999 – 2006	Bank profitability and risk management practices	Regression – Fixed Effects and Instrumental Variable Analysis	Liquidity measures as liquid assets to total deposit and borrowing is statistically significant but negatively related to bank profitability.

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Finding
Pasiouras and Kosmidou (2007)	15 EU Countries	1995 – 2001	Determinants of bank profitability (ROAA)	Regression – Fixed Effects	Bank profitability is statistically significant and negatively associated to the level of liquid assets held by domestic banks; however, it shows a positive relationship with liquid assets in case of foreign banks.
Kosmiduo (2008)	Greece	1990 – 2002	Determinants of performance of Greek banks	Unbalanced Pooled Time Series Fixed Effects Regression	The banks with high ratio of net loans to customer and short-term funding as a measure of liquidity risk are less profitable in terms of return on assets.
Alexiou and Sofoklis (2009)	Greece	2000 – 2007	Determinants of bank profitability	Regression – Fixed Effects	Loans to deposit ratio is statistically significant and negatively related to bank profitability.
Sufian and Habibullah (2009)	China	2000 – 2005	Firm specific and macroeconomic determinants of bank profitability	Regression – Fixed Effects	More liquid state-owned banks show higher profitability. This implies that liquidity is positively related to bank performance
Naceur and Kandil (2009)	Egypt	1989 – 2004	Effect of capital regulations on banks' performance and stability	Generalized Method of Moments (GMM)	Liquid assets are statistically significant and negatively related to profitability of domestic banks.
Alexiou and Sofoklis (2009)	Greece	2000 – 2007	Determinants of bank profitability	Regression – Fixed Effects	Loans to deposit ratio is statistically significant and negatively related to bank profitability.
Shen, Chen, Kao and Yeh (2010)	12 advanced economies	1994 – 2006	Firm specific and macroeconomic, supervisory and regulatory determinants of bank profitability	Regression – Fixed Effects	Liquidity risk measured as financing gap ratio is statistically significant and positively associated with banks' net interest margin, in market-based financial systems. However, a negative significant relationship is established between liquidity risk and return on average assets as well as return on average equity of the sample banks
Sufian (2011)	Korea	1192 – 2003	Firm specific and macroeconomic determinants of bank profitability	Regression – Fixed Effects	Bank liquidity is negatively related to performance
Ommeren (2011)	European banks	2000 – 2009	Determinants of bank profitability	2-step System GMM	Liquid assets to short-term funding as a measure of liquidity shows negative but statistically insignificant relationship with return on average assets
Curak (2012)	Macedonia	2005 – 2010	Bank-specific, industry-specific and macroeconomic	2-step System GMM	Banks holding more liquid assets generate significantly less profitability

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Finding
			determinants of bank profitability		
Olagunju, David, and Samuel (2012)	Nigeria	2011	Liquidity management and bank performance	Descriptive – Structured and Unstructured Questionnaire	Liquidity management has a significant effect on bank profitability. An optimum liquidity level needs to be maintained as both illiquidity and excess liquidity have adverse effects on bank profitability.
Ariffin (2012)	Islamic banks from Malaysia	2006 – 2008	Liquidity risk and bank performance during global financial crisis	Descriptive Statistics and Pearson Correlation Analysis	Liquidity risk measured as liquid assets to liabilities is positively correlated with ROA of Islamic banks from 2006 to 2008. However, negative correlation was found in 2007 between liquidity risk and both performance measures (i.e., ROA and ROE).
Haron (2004)	Islamic banks		Determinants of Islamic bank profitability	Panel Data Dummy Variable Regression	Financing to deposit ratio as a measure of bank liquidity is significantly and positively associated with the profitability of Islamic banks.
Srairi (2009)	18 Islamic and 48 Conventional banks in GCC region	1999 - 2006	Impact of bank-specific, macroeconomic and financial structure factors on profitability in dual banking system	Regression – Pooled OLS, FE and RE	Islamic banks that hold less liquid assets are more profitable. In addition, bank capital, loan growth, inflation and financial market development are the significant positive contributors of Islamic bank profitability. Whereas, operating efficiency is negatively correlated with the profitability of Islamic banks.
Asutay and Izhar (2007)	1 Islamic bank in Indonesia	1996 – 2001	Internal and external determinants of Islamic banks profitability.	Regression – OLS	Bank liquidity shows a significant and negative relationship with profitability of Indonesian Islamic bank.
Wasiuzzaman and Tarmizi (2010)	16 Islamic banks in Malaysia	2005 – 2008	Internal and external determinants of Islamic banks' profitability	Regression – OLS	Liquidity and operational efficiency significantly and positively related to Islamic bank profitability. In addition, both economic growth and inflation show a positive influence on bank performance. Whereas, bank capital and asset quality are negatively correlated with the profitability of the sample Islamic banks.
Rachdi and Mokni (2014)	15 Islamic and 15 conventional banks in MENA region	2002 – 2009	Bank profitability assessment in a dual banking system.	Generalized Method of Moments (GMM)	Liquidity risk and ownership structure are significantly and positively associated with profitability of Islamic banks, while operating efficiency is negatively related to bank profitability.

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Finding
Idris et al. (2011)	9 Islamic banks in Malaysia	2007 – 2009	Determinants of Islamic bank profitability	Generalized Least Squares (GLS)	No significant relationship between bank liquidity and profitability.
Chowdhury and Rasid (2015)	44 Islamic banks from Asian and	2013	Factors influencing the profitability of the Islamic banks	OLS	Liquidity risk and credit risk and economic growth are insignificant in explaining profitability of Islamic banks during the study period. Equity financing and inflation have significant and positive relationship with banks' profitability. Whereas, operating cost has a significant negative impact on profitability of Islamic banks.
Mirzaei (2011)	175 Islamic and conventional banks in 12 Middle Eastern countries	1999 – 2008	Determinants of bank risk and return in Islamic and conventional banking system	FE and GMM	Liquid assets ratio, as a measure of bank liquidity is significantly and positively associated with return on assets, while it shows a significant and negative relationship with return on equity.

2.5 Empirical Literature on Maturity Transformation Risk and Bank Stability

The role of banks as liquidity transformers, and the inherent fragility associated with this role, has long been studied in the seminal papers of Bryant (1980) and Diamond and Dybvig (1983).[6] These studies reveal that maturity mismatch between assets and liabilities makes them inherently unstable, by exposing them to the possibility of panic-based bank runs. This not only hold true for banks' balance sheet business, but also for the lending and funding business conducted through off-balance sheet items (Kashyap et al., 2002; Holmström & Tirole, 1998).

Some studies argue that higher asset liquidity facilitates the sale of bank assets during financial distress - and hence reduces banks' incentive to avoid them. Therefore, banks may assume additional risks (credit risk and capital risk) and so increase the probability of default. Diamond and Rajan (2001) argue that bank liquidity creation is a driver of financial fragility and propose that high liquidity transformation is most likely reason behind bank failures. With an increase in liquidity creation function, banks may be forced to sell their illiquid assets in order to meet unexpected withdrawals from depositors during stress conditions. Thus, they elevate the risk of failure when assets are insufficient to meet non-contingent commitments (Allen & Gale, 2004).

Empirical evidence has shown that high liquidity creation may be detrimental to bank stability, using private credit as a proxy for liquidity in the system. Cottarelli, Dell'Ariccia, and Vladkova-Hollar (2005) found that the ratio of credit to GDP increases by 5 to 10% prior to banking crises. Similarly, Demirgüç-Kunt and Detragiache (1998) and Kaminsky and Reinhart (1999) provide evidence that increased lending to the private sector usually precedes banking crises. Borio (2014) also contends that high loan growth is an impending signal of bank crises. In another empirical study, Nguyen, Skully, and Perera (2013) investigate the relationship between liquidity and bank stability and examine the effect of market power on this relationship. Using a large data set of 5,603 banks, from 113 countries, over the period of 1996 to 2010, the authors found that stability is positively associated with banks' liquidity.

[6] Banks transform liquidity through creating liquid claims or deposits on illiquid assets or loans.

However, their results show that banks with greater market power find incentive to increase their portfolio risk in order to charge higher rents and thus become less stable.

On the contrary, there are few studies which have found that higher bank liquidity makes them less vulnerable to idiosyncratic shocks because they can meet any unexpected large withdrawals or utilization of committed credit lines (Carletti, Hartmann, & Spagnolo, 2007; Wagner, 2007). Illiquidity serves as a channel through which contagion is spread across the banking sector (Allen & Gale, 2004) and which may result in a systemic meltdown (Diamond & Rajan, 2005). Bernanke (1983) supports this argument, claiming that a fall in liquidity creation can increase individual and systemic bank failures, thereby reducing credit supply and leading to an economic downward spiral.

In the empirical literature, Hong, Huang, and Wu (2014) employed a hazard model on quarterly panel data of US banks, between 2001 to 2011, to investigate the relationship of liquidity risk measures using Basel III liquidity regulatory ratios (net stable funding ratio (NSFR) and liquidity coverage ratio (LCR)). The authors argue that higher liquidity creation is a predictor of bank failure and suggest that in order to avoid such failures, liquidity risk should be minimized, not just on an individual bank level, but also at a system level as well. These findings support new liquidity requirements under the Basel III accord through which banks are now required to maintain and improve their solvency, even under high liquidity pressure. Similarly, Yan, Hall, and Turner (2012), studied the association between tighter capital regulations and Basel III liquidity requirements on a sample of 11 UK banks over the period of 1997 to 2010. They found that higher regulatory capital requirements not only reduce the probability of a banking crisis, but also reduce economic losses from a banking crisis. Moreover, Jiraporn, Chalermchatvichien, and Jumreornvong (2014) examine the impact of NSFR on bank risk-taking behaviour, using a sample of 68 banks from 11 East Asian countries between 2005 and 2009. Their findings revealed an inverse relationship between capital stability and banks' risk-taking, measured as Z-score.

Studies in the recent past have also attempted to investigate the influence of several internal and external factors on the stability of the Islamic banking sector. Čihák and Hesse (2010) attempted to examine the role of Islamic banking on financial stability. The authors used a large sample (77 Islamic banks and 397 conventional banks), from 18 countries, over the

period of 1993 to 2004. By applying Z-score as a measure of financial stability, the findings revealed that small Islamic banks are more stable than small conventional banks. Moreover, small Islamic banks showed greater financial stability than large Islamic and conventional banks. The authors argued that large Islamic banks are deterrent to overall financial stability.

Examining the financial performance and stability of the banking sector in the Middle Eastern, Mirzaei (2011) found that liquidity is a significant determinant of Islamic banks' stability. The author used Z-score and Sharp ratio to measure the banks' stability and found that the liquid assets ratio is positively associated with the stability measures used in the study. In a comparative study on the business model, efficiency and stability of Islamic and conventional banks, Beck, Demirgüç-Kunt, and Merrouche (2013) revealed that Islamic banks are more stable, better capitalized, have higher intermediation ratios and asset quality, and are less cost efficient than conventional banks. The findings also revealed that small Islamic banks are more reliant on market funding, have higher mismatches in maturities of assets and liabilities, and are better capitalized than larger Islamic banks.

In a recent study, Trad, Trabelsi, and Goux (2017) examined the role of Islamic banking on overall financial stability. The authors used a dataset of 78 Islamic banks, from 12 different countries, from 2004 to 2013. They found inconclusive evidence on the liquidity – stability relationship. The findings revealed that liquidity, when measured as liquid assets to total assets ratio, is significantly and positively associated with banks stability. Conversely, the ratio of liquid asset to customer deposit and short-term funding, as a measure of liquidity, showed a significant and negative relationship with bank stability.

To the best of our knowledge, there is only one study by Ashraf, Rizwan, and L'Huillier (2016), which specifically focuses on the influence of IFSB's proposed NSFR on the stability of Islamic banks. Using a large unbalanced dataset of 136 Islamic banks, from 30 different countries, between 2000 and 2013, the authors examined the potential impact of NSFR on bank stability. The authors found that the inclusion of this new regulatory measure has a significant impact in explaining the increased stability of Islamic banks. The results further revealed that the marginal impact of NSFR on bank stability decreases with an increase in bank asset size. The empirical literature on the liquidity and bank stability relationship is summarized in Table 2.3.

Table 2.3. Summary of Empirical Studies on Maturity Transformation Risk and Bank Stability

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Finding
Cottarelli et al. (2005)	24 European countries	1973 – 1996	Influence of bank credit ratios on macroeconomic development and financial stability.	Random Effects	Higher bank-credit-to-GDP ratio, as a measure of liquidity creation increases financial distress.
Demirgüç-Kunt and Detragiache (1998)	45 countries from developed and developing economies	1980 – 1994	The determinants of banking crises.	Multivariate Logit Model	Bank liquidity is positively correlated with financial stability, whereas, higher credit to private sector induces financial fragility. In addition, the likelihood of financial crisis increases during weak economic conditions and with high real interest rates.
Kaminsky and Reinhart (1999)	20 countries	1970 – 1995	The relationship between banking and currency crises.	Descriptive Statistics	Increased lending to the private sector usually precedes banking crises.
Nguyen et al. (2013)	5,603 banks from 113 countries	1996 – 2010	Influence of bank liquidity on stability. The role of market power in explaining liquidity – stability relationship.	Generalized Method of Moments (GMM)	Banks which maintain high levels of liquid assets are more stable. Moreover, with increased market power, banks tend to increase their portfolio risks for higher gains, and thus are less stable.
Yan et al. (2012)	11 UK banks	1997 – 2010	Cost – benefit analysis of Basel III capital and liquidity requirements	Non-linear Probit Model, VAR and VECM	Inclusion of Basel III liquidity and capital requirements are significantly beneficial to the financial stability and economic growth, in the long-run.
Hong et al. (2014)	9,349 US commercial banks	2000 – 2011	Causal relationship between Basel III liquidity risk measures and bank failure.	OLS and FE	NSFR is significantly and negatively related to bank failure. In addition, the Idiosyncratic liquidity risk has a limited impact on bank failures, whereas systemic liquidity risk is a major contributor to financial crisis.
Jiraporn et al. (2014)	68 banks from 11 East Asian countries	2005 – 2009	Impact of NSFR on risk-taking behavior of banks	Ordinary Least Squares (OLS)	The extent of bank risk-taking significantly decreases with an improvement in capital stability, which in turn reduces the probability of a financial distress.
Čihák and Hesse (2010)	77 Islamic and 397 conventional Banks from 19 countries	1993 – 2004	Islamic banking and financial stability	Ordinary Least Squares (OLS)	Small Islamic banks are more stable than small conventional banks. Large conventional banks are financially stronger than large Islamic banks. Small Islamic banks are more stable than large Islamic banks.

Author/s	Sample/ Country(ies)	Study Period	Research Focus	Methodology	Main Finding
Mirzaei (2011)	175 Islamic and conventional banks from 12 Middle Eastern countries	1999 – 2008	Determinants of bank risk and return in Islamic and conventional banking system	FE and GMM	Liquid asset ratio, as a measure of bank liquidity shows a significant and positive relationship with banks' stability.
Beck, Demirgüç-Kunt, et al. (2013)	88 Islamic and 422 conventional banks from 22 countries	2005 – 2009	Comparative analysis of business model, efficiency and stability in Islamic and conventional banks.	OLS and FE	Islamic banks are more stable, better capitalized, have higher intermediation ratios and asset quality, and are less cost efficient than conventional banks. In addition, small Islamic banks are more reliant on market funding, have higher mismatches in maturities of assets and liabilities, and are better capitalized than larger Islamic banks.
Trad et al. (2017)	78 Islamic banks from 12 countries	2004 - 2013	Risk and profitability of Islamic banks	System GMM	The ratio of liquid assets to total assets is positively correlated with bank stability, while liquid asset to customer deposit and short-term funding is inversely related to bank stability. In addition, bank size and capital are significant contributors to the increased financial soundness of Islamic banks, in terms of both profitability and stability.
Ashraf et al. (2016)	136 Islamic banks from 30 countries	2000 – 2013	Impact of NSFR on stability of Islamic banks	Dynamic Pooled OLS and Two-stage Least Squares (2SLS)	Inclusion of NSFR increases the financial stability of Islamic banks.

2.6 Measures of Maturity Transformation Risk

Deep and Schaefer (2004) were the first to empirically measure the maturity transformation risk. They estimated transformation risk as the difference between liabilities due within one year (liquid liabilities), and near cash (liquid) assets, scaled to gross assets. The authors used panel regression analysis on data from the 200 largest US banks, from 1997 to 2001. Their result showed that banks exhibited unexpectedly low liquidity transformation of about 20%. Their study also revealed that deposit insurance provides less incentive for the banks to perform their liquidity transformation function, as insured deposits generally replace uninsured liabilities, instead of expanding the deposit base or encouraging banks to make more loans. Further, the credit risk in loan portfolios appears to discourage liquidity transformation.

Berger and Bouwman (2009) used a more sophisticated approach to measure liquidity creation, where they classified assets and liabilities according to product category and maturity. They included off-balance sheet activities, not considered by Deep and Schaefer (2004). Their study found a positive and significant relationship between capital and liquidity transformation for large banks. This was negative for small banks.

Although liquidity creation increases banks illiquidity and transformation risk, Berger and Bouwman's (2009) measure for liquidity creation does not indicate to what extent liquidity creation may become damaging for a bank, in terms of excessive liquidity creation and exposure to transformation risk. To overcome this issue, Angora and Roulet (2011) used the Basel III accord guidelines, and determined the net stable funding difference (NSFD) as a measure of "how much is too much," for liquidity creation in the US and European banks. NSFD is derived by scaling the difference between the required amount of stable funding and the available amount of stable funding on total assets.

Chapter 3

Data and Methodology

This chapter identifies various estimation procedures applied to achieve the objectives of this study. More specifically, section 3.1 explains the data sources. Section 3.2 presents the regression models. The selection of dependant and independent variables for each of the research questions are justified in sections 3.3, 3.4 and 3.5. Section 3.6 explains the selection of the study's estimation techniques.

3.1 Data Sources

This study applies an unbalanced panel dataset, comprising of 55 full-fledged Islamic banks, from 11 Islamic states of Asia and the MENA region, for a period of 10 years (from 2006 – 2015), to ascertain the determinants of banks' maturity transformation risk and the effect of this maturity transformation risk on Islamic banks' performance and stability. The selection of the sample countries is based on the common religious belief as the majority of these populations are Muslim. Following Lee and Hsieh (2013), we deleted dropped banks from the sample if the data are available for three years or less. Further the banks selected for this study are listed banks with publicly available annual reports from their web sites. Secondary data based on the annual financial reports of the sample banks is acquired from Bloomberg database and cross-validated with their published annual reports. Data on macroeconomic variables is retrieved from the World Bank database[7]. Table 3.1 shows the name of the countries and the number of Islamic banks from each country selected for our study. the annual and geographic observation distribution of Islamic banks is reported in

[7] See http://data.worldbank.org/indicator for data on macroeconomic variables of each country.

Table 3.1. Sample of Banks and Observations

No.	Country	Bank number	Observations
1	Bahrain	6	60
2	Bangladesh	7	50
3	Egypt	3	30
4	Indonesia	6	43
5	Kuwait	5	44
6	Malaysia	8	64
7	Pakistan	4	35
8	Qatar	4	34
9	Saudi Arabia	4	37
10	Turkey	3	27
11	UAE	5	46
Total		55	468

Source: Author's own computation based on data from the Bloomberg database (2006 – 2015) and banks' annual reports.

Table 3.1A reports the annual and geographic observation distribution of Islamic banks included in this study.

Table 3.2A. Annual and Geographic Observation Distribution of Islamic Banks

Country	Banks	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bahrain	Albaraka Banking Group	1	1	1	1	1	1	1	1	1	1
	Alsalam Bank	1	1	1	1	1	1	1	1	1	1
	Arab Banking Corp Bsc	1	1	1	1	1	1	1	1	1	1
	Bahrain Islamic Bank	1	1	1	1	1	1	1	1	1	1
	Ithmaar Holding Bsc	1	1	1	1	1	1	1	1	1	1
	Khaleeji Commercial Bank	1	1	1	1	1	1	1	1	1	1
Bangladesh	Al-Arafah Islami Bank Ltd	0	0	0	1	1	1	1	1	1	1
	Exim Bank	0	0	0	1	1	1	1	1	1	1
	First Security Islami Bank Ltd	0	0	0	1	1	1	1	1	1	1
	Icb Islamic Bank Ltd	0	0	0	1	1	1	1	1	1	1
	Islami Bank Bangladesh Ltd	0	0	1	1	1	1	1	1	1	1
	Shahjalal Islami Bank Ltd	0	0	0	1	1	1	1	1	1	1
	Social Islami Bank Ltd	0	0	0	1	1	1	1	1	1	1
Egypt	Abu Dhabi Islamic Bank/Egypt	1	1	1	1	1	1	1	1	1	1
	Al Baraka Bank Egypt E.S.C	1	1	1	1	1	1	1	1	1	1
	Faisal Islamic Bank Of Egypt	1	1	1	1	1	1	1	1	1	1
Indonesia	Bank Bca Syariah	0	0	0	0	1	1	1	1	1	1
	Bank Bni Syariah	0	0	0	0	1	1	1	1	1	1
	Bank Bri Syariah Pt	0	0	1	1	1	1	1	1	1	1
	Bank Muamalat Indonesia Tbk	0	0	1	1	1	1	1	1	1	0
	Bank Panin Syariah Tbk Pt	0	0	0	1	1	1	1	1	1	1
	Bank Syariah Mandiri Pt	0	1	1	1	1	1	1	1	1	1
Kuwait	Ahli United Bank	1	1	1	1	1	1	1	1	1	1
	Boubyan Bank	1	1	1	1	1	1	1	1	1	1

	Kuwait Finance House Bsc	1	1	1	1	1	1	1	1	1	1
	Kuwait International Bank	1	1	1	1	1	1	1	1	1	1
	Warba Bank	0	0	0	0	0	0	1	1	1	1
Malaysia	Affin Islamic Bank	1	1	1	1	1	1	1	1	1	1
	Ambank Islamic	1	1	1	1	1	1	1	1	1	1
	Bank Islam Malaysia	1	1	1	0	0	1	1	1	1	1
	Bank Muamalat Malaysia Bhd.	1	1	1	1	0	0	0	0	0	0
	Cimb Islamic Bank Bhd.	0	0	1	1	1	1	1	1	1	0
	Hong Leong Islamic Bank Bhd.	0	1	1	1	1	1	1	1	1	1
	Public Islamic Bank Bhd.	0	0	1	1	1	1	1	1	1	1
	Rhb Islamic Bank Bhd.	0	0	1	1	1	1	1	1	1	1
	Al Baraka Bank (Pakistan) Ltd.	1	1	1	1	1	1	1	1	1	0
Pakistan	Bankislami Pakistan Ltd.	0	0	1	1	1	1	1	1	1	1
	Dubai Islamic Bank Pakistan Ltd.	0	1	1	1	1	1	1	1	1	0
	Meezan Bank	1	1	1	1	1	1	1	1	1	1
	Barwa Bank	0	0	0	0	1	1	1	1	1	1
	Masraf Al Rayan (Q.S.C.)	0	0	1	1	1	1	1	1	1	1
Qatar	Qatar International Islamic Bank (Q.S.C)	1	1	1	1	1	1	1	1	1	1
	Qatar Islamic Bank (S.A.Q)	1	1	1	1	1	1	1	1	1	1
	Al Rajhi Bank	1	1	1	1	1	1	1	1	1	1
Saudi Arabia	Alinma Bank	0	0	0	0	1	1	1	1	1	1
	Bank Albilad	1	1	1	1	1	1	1	1	1	1
	Bank Al-Jazira	1	1	1	1	1	1	1	1	1	1
	Albaraka Turk Katilim Bankas	1	1	1	1	1	1	1	1	1	1
Turkey	Asya Bank	1	1	1	1	1	1	1	1	1	0
	Turkye Finans Katilim Bankasi	0	0	0	1	1	1	1	1	1	1
	Abu Dhabi Islamic Bank	1	1	1	1	1	1	1	1	1	1
	Al Hilal Bank (Pjsc)	0	0	0	0	1	1	1	1	1	1
United Arab Emirates	Dubai Islamic Bank	1	1	1	1	1	1	1	1	1	1
	Emirates Islamic Bank	1	1	1	1	1	1	1	1	1	1
	Sharjah Islamic Bank	1	1	1	1	1	1	1	1	1	1
	Observations per Year	30	33	41	48	52	53	54	54	54	49

Source: Author's calculation based on data from the Bloomberg database (2006 – 2015)

3.2 Econometric Model Specifications

3.2.1 Determinants of Maturity Transformation Risk Model

This section presents specifications of the econometric model adopted to identify the determinants of maturity transformation risk in Islamic banks. Previous studies have

documented that various factors (for example, bank capital, fee income, loan loss provisions, size, inflation and gross domestic product), have a significant influence on the liquidity transformation function and risk of conventional banks. These factors are classified into bank specific, industry specific, macroeconomic and supervisory or regulatory factors (Aspachs et al., 2005; Shen et al., 2009). Following Shen et al.'s (2009) study, we specify the following general linear model to analyze the influence of internal and external factors on the maturity transformation risk in Islamic banks.

$$MTR_{it} = \partial_1 MTR_{it-1} + \sum_{b=1}^{B} \vartheta_b \Pi_{it}^{b} + \sum_{m=1}^{M} \lambda_b \Pi_{jt}^{m} + \varepsilon_{it} \qquad \textbf{(3.1)}$$

Where:

$\varepsilon_{it} = \mu_i + v_{it}$

(MTR_{ijt}) = dependent variable for bank 'i' of country 'j' at time 't', with '$i = 1 \ldots N$ and $t = 1 \ldots T$'.

N is the number of banks and *T* defines the length of the sample period.

($\prod_{it}^{b}, \prod_{it}^{m}$) = denote to bank-specific and macroeconomic variables, respectively.

(ε_{it}) = disturbance term.

(μ_i) = unobserved heterogeneity (the fixed effect).

(v_{it}) = idiosyncratic error.

Equation (3.1) is a one-way error component regression, where (μ_i) is ~IIN (0, $\sigma_{\mu_i}^2$) and independent of (v_{it}) which is ~IIN (0, $\sigma_{v_{it}}^2$).

The selection of the dependent variable and explanatory variables, including various bank-specific and macroeconomic factors, introduced in equation (3.1) is discussed in section 3.4.

3.2.2 Maturity Transformation Risk and Banks' Performance Model

In the quest to ascertain the effect of maturity transformation risk on bank performance, the following linear model is specified based on the previous literature (Abduh & Idrees, 2013; Athanasoglou, Brissimis, & Delis, 2008; Dietrich & Wanzenried, 2011) and is shown in equation (3.2).

$$\boldsymbol{\pi_{it} = \alpha_0 + \partial_1 \pi_{it-1} + \delta_1 MTR_{it} + \sum_{b=1}^{B} \vartheta_b \prod_{it}^{b} + \sum_{l=1}^{L} \phi_l \prod_{jt}^{l} + \sum_{m=1}^{M} \lambda_m \prod_{jt}^{m} + \varepsilon_{it}} \quad \textbf{(3.2)}$$

Where (π_{it}) denotes the dependent variable as a measure of profitability, and is estimated by return on average assets (ROAA) or return on average equity (ROAE). j represents a country in which bank i operates at time t, with $i = 1, \dots, N$ and $t = 1, \dots, T$. N represents the number of cross-sectional observations and T is the length of the sample period. Further the model consists of a constant term α and a vector of $k \times 1$ parameters $(\partial, \delta, \vartheta, \phi, \lambda)$ that estimate the sign and slope of the regressors. The explanatory variables are grouped into bank-specific $\prod_{it}^{b}$, industry-specific $\prod_{it}^{l}$ and macroeconomic variables $\prod_{jt}^{m}$. Finally, ε_{it} refers to the stochastic error component, capturing unobserved heterogeneity (fixed-effect) μ_i and an independent idiosyncratic effect v_{it} , and is assumed to be identically and independently distributed with mean 0 and variance σ_ε^2.

Previous studies have provided evidence that bank profitability shows a tendency to persist over time (Athanasoglou et al., 2008; Berger, Bonime, Covitz, & Hancock, 2000; Dietrich & Wanzenried, 2011; Goddard, Liu, Molyneux, & Wilson, 2011). Following the literature, our study also adopts the dynamic characteristic of the model, by including a one-period lagged dependent variable $\pi_{i,t-1}$ of bank i at time t among the explanatory variables. The coefficient of the one-period lagged dependent variable ∂ measures the adjustment speed of banks' profitability to equilibrium. A value of the coefficient between 0 and 1 reflects the persistence of profits over the time, which will eventually return to the equilibrium level. Athanasoglou et al. (2008) explains that a coefficient value near 0 implies a fairly competitive market structure with a high speed of adjustment, while a value near 1 reflects a less competitive industry with a low speed of adjustment.

The selection of the dependent variable and explanatory variables, including various bank-specific, industry-specific and macroeconomic variables, introduced in the regression model (equation 3.2) are discussed in section 3.5.

3.2.3 Maturity Transformation Risk and Bank Stability Model

This section investigates the contribution of maturity transformation risk in explaining the overall bank stability, while controlling for other bank specific, industry and macro-economic factors. Following the literature on financial stability (Beck, Demirgüç-Kunt, et al., 2013; Čihák & Hesse, 2010; Nguyen et al., 2013), we specify the following model in a general linear form as:

$$\boldsymbol{S_{it} = \alpha_0 + \gamma_1 S_{it-1} + \delta_1 MTR_{it} + \sum_{b=1}^{B} \vartheta_b \prod_{it}^{b} + \sum_{l=1}^{L} \phi_l \prod_{jt}^{l} + \sum_{m=1}^{M} \lambda_m \prod_{jt}^{m} + \varepsilon_{it}} \qquad \textbf{(3.3)}$$

The subscripts i, j and t refer to individual banks, countries and time horizon. S denotes the dependent variable as a measure of bank stability. γ measures the magnitude of contribution of stability from previous years, δ determines the sign and the slope of maturity transformation risk (MTR) on bank stability. $\prod_{it}^{b}, \prod_{jt}^{l}, \prod_{jt}^{m}$ are the vectors of bank-specific, industry-specific and macroeconomic variables, respectively. ϑ, ϕ, λ are the parameters to be estimated, along with a constant measured by a scaler α. $\varepsilon_{it} = \mu_i + v_{it}$ is the error term. The model is specified as a one-way error component regression, where μ_i is ~IIN (0, $\sigma_{\mu_i}^2$) and is independent of v_{it} which is ~IIN (0, $\sigma_{v_{it}}^2$).

The selection of the dependent variable and other explanatory variables, including various bank-specific, industry-specific and macroeconomic variables in equation (3.3), are discussed in section 3.5.

3.3 Justification of Variable Selection in Determinants of Maturity Transformation Risk Model and Hypotheses Development

This section develops the foundation for identifying various factors that determine maturity transformation risk in the Islamic banking system. In our literature review chapter, we have summarized the theoretical and empirical explanations for various relationships with bank

exposure to maturity transformation risk. The findings from the review are used to hypothesize expectations for the relationship of different determinants.

This section further extends the discussion into two main parts. First, it reviews the dependent variable as the proxy for banks' maturity transformation risk, followed by the selection of explanatory variables, categorized into bank-specific and macroeconomic determinants of maturity transformation risk, in selected Islamic banks. Second, it also hypothesizes the expected sign for the relationship between maturity transformation risk and the explanatory variables.

3.3.1 Dependent Variable

Net Stable Funding Ratio:

In the aftermath of the US 2007 subprime loan crisis, the need for improved bank liquidity management practices, drew increasing regulatory attention. To address these requirements, the Basel Committee on Banking Regulation and Supervision (BCBS) proposed several international guidelines for banks to assess their liquidity position (BIS, 2009). Among them, the Basel III accords include the implementation of NSFR across the globe. This ratio is a micro-prudential measure of maturity transformation risk that limits the banks to excessively rely on un-stable short-term funding (Arvanitis & Drakos, 2015). In other words, it proposes managing the bank's liquidity position over a one-year period by introducing continuous structural changes in the bank's balance sheet, to fund their activities with more stable funding sources.

In an attempt to harmonize the robust management and monitoring of liquidity risk in the Islamic banking industry, across the Islamic jurisdictions, the Islamic Financial Services Board (IFSB) endorsed the Basel III liquidity regulations, with some modifications to the criteria to calculate the NSFR, to account for the unique asset and liability structure of Islamic banks. IFSB issued the Guidance Note No. 6 (GN-6), to calculate the net stable funding ratio for Islamic banks (IFSB, 2015).

Similar to the conventional banking system, the NSFR (under the IFSB's guidelines), is a ratio of the available amount of stable funding to the required amount of stable funding. The available amount of stable funding constitutes bank capital, liabilities with residual maturities

of one year or more, and stable deposits.[8] The required amount of stable funding is the value of bank assets that are difficult to liquidate or utilize as collateral in secured borrowing, during liquidity stress conditions, over a one-year period.

The net stable funding ratio is calculated as:

$$NSFR = \frac{Available\ amount\ of\ stable\ funding}{Required\ amount\ of\ stable\ funding} > 100\% \quad \textbf{(3.4)}$$

To calculate the available amount of stable funding (ASF) and required amount of stable funding (RSF) utilizing the IFSB guidelines, each of the assets and liabilities categories are assigned appropriate weights. For example, to calculate RSF factor, the highly liquid assets (cash) receive a weighting of 0%. A 100% weight is assigned to highly illiquid assets (fixed assets). For the ASF factor, the weights assigned to funding sources depends on their stability and ranges from 100% for total regulatory capital (excluding Tier 2 with residual maturity less than one year) to 0% for net *Sharı'ah*-compliant hedging instruments. A detailed breakdown of the proposed weights assigned to the respective balance sheet items of Islamic banks is provided in Appendix Table A.1.

Although the IFSB's GN-6 provides comprehensive quantitative guidelines, the major limitation in calculating the NSFR is the lack of available granular data on liquidity risk reporting across Islamic banks. Most of the NSFR related studies in the recent past, use the approximation method to assign weights to various balance sheet items, while calculating the NSFR utilizing Basel III guidelines (Giordana & Schumacher, 2011; Gobat, Yanase, & Maloney, 2014; Hong et al., 2014; King, 2013). These assumptions are in line with broader interpretations of corresponding assets and liabilities, giving due consideration to their liquidity and maturity profile. Following the conventional approach, to compute the NSFR variable, we made the following assumptions in regard to liquidity and the maturity of various balance sheet items of Islamic banks, according to Ashraf et al.'s (2016) methodology.

[8] A portion of non-maturity deposits and term deposits, with effective maturities of less than one year, are expected to stay within the institution.

a) The conservative approach is applied when treating the financing. A weighting of 85% is assigned to all financing with a residual maturity of less than 1 year, while a weighting of 100% is assigned to all other financing with a residual maturity of more than one year.

b) Since the classification of encumbered and unencumbered assets and high-quality liquid assets (HQLAs) is not available in most of the publicly available data, we assigned a 5% weight to investment in government securities, consistent with the GN-6 NSFR, and a 50% weighting to all other securities with a maturity of more than one year.

c) A 100% weight is assigned to all other assets, including fixed assets financing to financial institutes with a residual maturity of more than one year and 5% to the off-balance sheet items.

d) We also assumed a 100% weight for total regulatory capital.

e) A 50% haircut is applied to all non-remunerative deposits and funding from financial institutions with a residual maturity of less than one year.

f) Because of the limitation in publicly available data on the classification of stable and unstable deposits, we utilized the maturity disclosure of banks' funding. A factor of 95% is assigned to all deposits with a residual maturity of more than one year and a 90% factor is assigned to deposits with a residual maturity of less than one year, consistent with the GN-6 guidelines.

Equation 3.5 shows the mathematical from of the NSFR (IFSB, 2015), as follows:

$$NSFR = \frac{\begin{array}{c}[0.5 * (\text{dem\_deposit} + \text{st\_ market\_debt} + \text{other\_st\_liab}) \\ + 0.90 * (\text{dep} < 1\ \text{year}) + 0.95 * (\text{dep} > 1\ \text{year}) + 1 * (\text{lt\_market\_libilities} + \text{reg\_cap})]\end{array}}{\begin{array}{c}[0.05 * (\text{gov\_sec} + \text{OBS}) \\ + 0.5 * (\text{lt\_marketable\_assets} + \text{fin\_FIs} < 1\ \text{year}) \\ + 0.65 * (\text{real\_estate} > 1\ \text{year}) + 0.85 * (\text{const\_loans} < 1\ \text{year}) \\ + 1 * (\text{const\_loans} > 1\ \text{year} + \text{other\_loans} + \text{other\_assets} + \text{fixed\_assets})]\end{array}} \quad \textbf{(3.5)}$$

A higher value of *NSFR* corresponds to more stable funding available than the required amount of stable funds, in which case the banks find less difficulty in meeting their current liquidity obligations. Whereas, the lesser value of this ratio refers to the extent of a bank's inability to meet unexpected customer withdrawal requirements, without borrowing money from external sources or fire selling assets at a discount, consequently exposing them to an increased maturity transformation risk (Roulet, 2011).

3.3.2 Explanatory Variables

In this study, we include the following banks-specific, and macroeconomic explanatory variables, to determine their effect on maturity transformation risk in the Islamic banking system.

3.3.2.1 Bank – specific Factors

Capitalization: Among bank-specific variables, bank capital signifies the degree of cushion maintained by the bank, to absorb losses from ongoing operations, when exposed to risk and uncertainty. Under the risk absorption theory, Allen and Gale (2004) ascertained that higher capital requirements increase the liquidity creation of financial institutions. The study revealed that increased liquidity creation exposes banks to higher levels of risk, as losses increase with levels of illiquid assets required to satisfy customer liquidity demands. This activity is directly related to the risk transformation role of the financial intermediaries (Al-Khouri, 2012). Increased liquidity needs encourage banks to incur higher losses due to the disposal of illiquid assets at available market prices, rather than desired prices, to meet customer obligations. However, higher bank capital has the ability to absorb these losses and expands the financial intermediaries' risk-bearing capacity (Bhattacharya & Thakor, 1993; Coval & Thakor, 2005).

On the contrary, Diamond and Rajan (2011) argue that a nominal intermediary service levy will be charged to depositors, to lend their respective deposits. However, the mismatch between this fee and the repayment capability of risky borrowers, will provoke depositors to withdraw their funds, promoting financial fragility. In extreme cases, this may lead to bank

runs, causing severe bank liquidity problems and affect the financial sector as a whole. Similar findings revealed by Gorton and Winton (2000), who argued the "crowding out effect" where the banks' preference to meet higher capital requirements by shifting investors' funds to their capital accounts. Nevertheless, these investments are susceptible to financial uncertainty and cyclical variations which are uninsured and difficult to withdraw when required, leading to a decrease in liquidity creation.

Based on the above discussion, *we hypothesize that maturity transformation risk decreases with increased levels of bank capital*.

Liquid Assets: Shen et al. (2009) argue that the nature of bank assets (and their ability to turn these into cash), are a key contributor of liquidity risk. They indicate that holding liquid assets can reduce a bank's liquidity risk, as during normal conditions a bank can sell or collateralize its liquid assets to obtain liquid funds. However, this may not hold true under liquidity stress conditions. Consequently, we categorized liquid assets into risky liquid assets (RLA) and less risky liquid assets (LRLA), to ascertain the degrees of liquidity of these assets. Further, we scaled the risky liquid assets and less risky liquid assets with the banks' total assets to standardize them. They are represented as RLA_TA and LRLA_TA, respectively. LRLA, such as cash and balances, with central banks, government sukuk and other short-term government securities, can be easily collateralized or sold with a minimum price risk. This process involves low transaction costs. *Thus, we hypothesize that an increase in proportion of less-risky liquid assets in total assets decreases banks' maturity transformation risk.* On the other hand, RLA includes medium and long-term investments in trading securities that are relatively difficult to sell or collateralize to meet liquidity requirements.

Therefore, we assume that a bank's maturity transformation risk increases with an increase in the proportion of risky liquid assets in the total assets.

Profitability: We are also interested in capturing capture the effect of banks' financial soundness on risk taking behaviour. In general, bank profitability explains the influence of

increased financial soundness on banks' risk bearing capacity and their ability to create liquidity (Shen et al., 2009). As a result, this increased financial strength may enhance the banks' ability to take risk, which yields a positive relationship between bank profitability and transformation risk. Moreover, profitability can also account for the "too big to fail" philosophy of large banks (Demirgüç-Kunt & Huizinga, 2010a; Zhou, 2010). Large banks may be exposed to increased maturity transformation risks as they can create more liquidity, even in stress conditions, in order to increase their profitability.

We therefore *hypothesize that financial soundness encourages banks to increase their liquidity creation function, which can lead to increased maturity transformation risk*.

Credit Risk: Many researchers have studied the impact of credit risk in determining transformation risk (Fungáčová et al., 2010; Berger & Bouwman, 2009; Deep & Schaefer, 2004). The lower the credit risk, the more aggressively a bank can extend its lending activities. Consequently, better asset quality encourages the banks to create more liquidity, which in turn leads to increased exposure to transformation risk.

Based on the above arguments, we *hypothesize an inverse relationship between credit risk and maturity transformation risk*.

Bank Size: Bank size is generally described in terms of net total assets. In line with the argument of the 'too big to fail' philosophy, the implicit regulator guarantee decreases banks' funding costs, which enable them to invest in more risky assets (Lannotta et al., 2007). Tesfaye (2012) contends that regulators' protection of large banks as the cause of the moral hazard problem. This also reduces banks' incentive to hold more liquid assets. This explains differences in liquidity creation among banks; in short, liquidity creation is relative to their size. As Delechat et al. (2012) reveal, liquidity increases with bank size. However, after a certain level the relationship turns counter wise. Further, Rauch et al. (2009) and Berger and Bouwman (2009) note that smaller banks are less involved in liquidity creation as they focus mainly on transformation activities and intermediation processes. These findings are in line

with some of the previous studies. Audretsch and Elston (2002) found that smaller banks possess relatively more liquid assets and less liquidity constraints. Similarly, Kashyap et al. (2002) also revealed the influence of bank size on liquidity creation and concluded that as smaller banks face constraints in accessing capital markets, they tend to maintain higher levels of liquidity.

Hence, we *hypothesize a positive effect of bank size on risk exposure*.

Non-Deposit Dependence: Banks that rely excessively on external sources of funding, rather than on core deposits, to fund their financing activities may face difficulties in meeting liquidity requirements when the need arises (Saunders & Cornett, 2007). Moreover, short-term market funding is relatively cheap and abundantly available under normal conditions, which provides banks with an incentive to fund their loans in order to inflate their balance sheets, for a short period of time. However, short-term market debt is considered less stable than long-term market funding and short-term deposits are considered more stable than short-term market debt (BIS, 2009). Consequently, the more banks are funded by market debts, the higher the potential instability of their funding sources, and the higher the degree of transformation risk exposure.

Thus*, we hypothesize a positive relationship between non-deposit dependence and maturity transformation risk.*

Market Power: Bank market power may influence the availability of funding (Petersen & Rajan, 1995) and the split of loan portfolios (Berger et al., 2005). The influence of bank market power on asset liquidity and funding liquidity has been studied by Nguyen et al. (2013). They found a quadratic relationship between market power and banks funding liquidity. Berger and Bouwman (2009) have also analysed bank liquidity creation and its relationship to transformation risk. The authors also found that banks with greater market power may enhance their liquidity creation by making more loans and attracting more funds, either from depositors or from the wholesale market.

Thus, we expect a positive relationship between banks' market power and exposure to transformation risk.

3.3.2.2 Macroeconomic Factors

Gross Domestic Product: Determining the impact of economic downturn, Bordo et al. (2001) argue that the degree of loan defaults is even higher during periods of recession. As a result, depositors perceive high solvency and risk triggering unexpected large deposit withdrawals. This leads to bank runs, causing liquidity risk and ultimately bank insolvency. Shen et al. (2009) came to similar conclusions. Analyzing the cyclical effect on bank liquidity preferences, Aspachs et al. (2005) propose that banks prioritize liquidity during periods of economic uncertainty when they have less opportunities to increase their lending assets. Painceira (2010) suggests that banks' incentive of holding more liquid assets decreases during economic booms, however, banks are likely to maintain high levels of liquidity during stress conditions.

We therefore *hypothesize that the banks increase their liquidity creation and their exposure to transformation risk during economic booms*.

Inflation: In our study, inflation is also included as another macroeconomic factor effecting maturity transformation risk. As Vodová (2013), revealed, bank vulnerability, in terms of nominal values of loans issued to borrowers, increases with rate increasing inflation rates. This hampers banks' liquidity creation function, as they are more likely to maintain their liquidity when the economy is under high inflationary pressure, thus reducing their exposure to maturity transformation risk.

Based on this argument, *we hypothesize an inverse relationship between inflation and risk.*

The extended form of equation (3.1) is conceptualized to determine the influence of the bank-specific and macroeconomic factors (as discussed in Shen et al. (2009)) on maturity

transformation risk, with respect to the restrictions specific to the products and activities of Islamic banking.

$$NSFR_{it} = \delta_1 NSFR_{it-1} + \vartheta_1 CAP_{it} + \vartheta_2 LRLA\_TA_{it} + \vartheta_3 RLA\_TA_{it} + \vartheta_4 ROAA_{it} + \vartheta_5 LLRTL_{it} + \vartheta_6 SIZE_{it} + \vartheta_7 NDD_{it} + \lambda_1 MP_{it} + \mu_1 GDP_{jt} + \mu_2 CPI_{jt} + \mu_i + v_{it} \quad (3.6)$$

Table 3.2 defines all of the selected variables included in equation (3.6), along with their expected signs.

Table 3.3. Definition of Variables in Determinants of Maturity Transformation Risk Model (Equation 3.6)

Category	Variables	Description/ Calculation	Exp. Sign
Dependent Variable			
Maturity Transformation Risk	NSFR	Net stable funding ratio is defined as the ratio of available amount of stable funding to required amount of stable funding	
Independent Variables			
Bank-specific			
Capitalization	CAP	Ratio of total regulatory capital to total assets.	-
Less-risky Liquid Assets	LRLA_TA	Ratio of less risky liquid assets to total assets. LRLA includes cash and balances with central banks, government sukuk other short-term sovereign securities.	+
Risky Liquid Assets	RLA_TA	Ratio of risky liquid assets to total assets. RLA includes inter-bank assets and other trading securities.	-
Profitability	ROAA	Ratio of net income to average total assets.	-
Credit Risk	LLRTL	Ratio of loan loss reserves to total loans.	+
Size	Ln_TA	Natural log of total assets	-

Non-deposit Dependence	NDD	Ratio of total short-term and long-term market debt to total liabilities.	-
	STB	Ratio of short-term borrowing to customer deposit and total short-term borrowing	-
Market Power	MP	Ratio of bank assets to industry total assets of a country	-
Macroeconomic			
Gross Domestic Product	GDP	Annual percentage growth in GDP	-
Inflation	CPI	Year-on-year change in consumer price index	+

Source: Author's calculations, Bloomberg (2006 – 2015), banks' annual reports, World Bank's World Development Indicators.

3.4 Justification for Variable Selection in Maturity Transformation Risk and Bank Performance Model

In this section, we justify the selection of both the dependent and independent variables for our empirical models.

3.4.1 Performance Measures

There is a wide range of empirical literature which uses return on assets (ROA), return on equity (ROE) and net interest margins (NIM) as accounting measures of bank performance (Abduh & Idrees, 2013; Dietrich & Wanzenried, 2011; Ommeren, 2011; Athanasoglou et al., 2008; Kosmidou et al., 2005).

In our study, we also use the return on average assets (ROAA) as our main measure of bank profitability. The ROAA is defined as the ratio of net income to average total assets expressed as a percentage. As an alternative profitability measure, we use the return on average equity (ROAE), which is the ratio of net profits to average equity, expressed as a percentage.

The ROAA is the most commonly used performance measure in the literature, which reflects a bank's ability to generate profits from its assets (Golin & Delhaise, 2013). It shows the profits earned per dollar of assets and indicates how effectively the bank's management utilizes its

assets to generate profits. To capture changes in assets during the financial year, our study relies on the average assets value. The other measure of profitability is the return on average equity (ROAE), defined as the return to shareholders on their equity. According to Flamini, Schumacher, and McDonald (2009) ROA is preferred over ROE as a measure of bank performance, because an analysis of ROE neglects higher risks associated with higher levels of financial leverage and the effect of regulation on leverage. Furthermore, studies using NIM as the performance measure of Islamic Banks are limited in the literature (Yannikaya, Gumus & Pabuccu, 2018).

Thus, we consider the ROAA as a better measure of profitability and use it as the main dependent variable, although we also report the results for the ROAE to check the robustness of our main results.

3.4.2 Independent Variables Affecting Bank Profitability

Previous studies have categorized factors affecting the profitability of banks into various internal and external determinants (Alexiou & Sofoklis, 2009; Athanasoglou et al., 2008; Kosmidou, 2008; Hassan & Bashir, 2003). Based on the existing literature, we included the following bank-specific, industry-specific and macroeconomic explanatory variables, to determine their effect on profitability in the Islamic banking system.

3.4.2.1 Bank – specific Factors

Maturity Transformation Risk (NSFR): This study focuses on the sensitivity of Islamic banks' profitability to their degree of exposure to maturity transformation risk. To address this issue, the net stable funding ratio, as a structural measure of maturity transformation risk, is included in our empirical analysis. Many previous studies have shown mixed empirical evidence on the effect of liquidity on bank performance. The higher proportion of available amount of stable funding may result in lower yields on banking assets, leading to less overall profit (Curak et al., 2012; Naceur & Kandil, 2009; Li, 2007). However, banks with less available liquid assets are mainly reliant on external funding sources which is associated with higher costs, consequently reducing the overall profitability of the bank (Olagunju et al., 2012; Goddard et al., 2011; Kosmidou, 2008; Bourke, 1989). Moreover, Bordeleau and Graham (2010) reveal a non-linear relationship between bank liquidity and profitability. The authors

assert that profitability increases with an increase in bank liquid asset holdings. However, there is an inverse relationship when the opportunity costs outweigh the benefits of holding liquid assets.

We, therefore hypothesize that maturity transformation risk is negatively associated with the profitability of Islamic banks.

Solvency: The ratio of equity to total asset, as a proxy of capital strength, is used in a number of previous empirical studies and is considered to be an important internal determinant of a bank's profitability (Demirgüç-Kunt & Huizinga, 2010b; Ben Naceur & Kandil, 2009; Athanasoglou et al., 2008; Kosmidou, 2008). These studies have established a positive relationship between bank capital and profitability. Well-capitalized banks are considered relatively safe during periods of financial distress (Shen et al., 2009). Besides, banks' expected profits may increase with an increase in capital due to lower bankruptcy costs. This ultimately banks' funding costs because of less dependence on external funding sources (Li, 2007; Abreu & Mendes, 2001).

Based on the above arguments supported by a large strand of previous studies, *we hypothesize a positive relationship between bank capital (equity-asset ratio) and profitability.*

Income Diversity: The increasing dependence on non-traditional banking activities in the recent past, has amplified the need to recognize income diversity as an important determinant of bank profitability. It measures the extent of deviation of a bank's activities from its primary role of intermediation. Following Molyneux and Yip (2013), we employed non-financing income scaled by gross income to measure Islamic banks' income diversity. Non-financing income consists of fee and commission income, income from the sale of investment securities and other non-financing income. Banks with diversified activities are more stable (Köhler, 2013) and have lower funding costs (Deng, Elyasiani, & Mao, 2007) thus benefiting from their increased market share prices and lower debt costs. Moreover,

Molyneux and Yip (2013), also highlighted the strong positive impact of non-financing income on risk adjusted returns of Islamic banks, which are less involved in diversified activities.

Hence, *we assume a positive relationship between income diversity and bank profitability*.

Size: Bank size is generally used in the previous academic literature to account for economies or diseconomies of scale in the banking industry. In his seminal paper, Short (1979) noted a strong positive correlation between size and a bank's capital strength, as relatively large banks tend to be more cost effective in raising capital and thus appear more profitable. Berger, Hanweck, and Humphrey (1987) and Athanasoglou et al. (2008) provide support for this argument. The authors highlight the cost benefits associated with large banks in growing economies. Similarly, in a cross-country context, Haron (1996, 2004), and Smaoui and Salah (2012), reveal that the profitability of Islamic banks is proportionate to their growing assets size. On the contrary, Kosmidou et al. (2005), Pasiouras and Kosmidou (2007) and Sufian and Habibullah (2009) have found evidence of diseconomies of scale for larger banks in their studies. Whereas, Eichengreen and Gibson (2001) found a non-linear relationship between size and bank profitability. They contest that bank size has a positive effect on its profitability up to a certain extent. However, beyond this point, an increase in bank assets can have a negative effect on its profitability. This is due to lower yields associated with increased diversification activities or a bureaucratic management style.

As the Islamic banking industry is relatively new and the majority of the banks are in a growing phase, it is expected profitability will increase as bank size increases and *thus, we hypothesize a positive size-profitability relationship.*

Asset Quality: For a banking institute, loans are the primary source of revenue generation. However, these loans are also considered as the major source of credit risk. A higher credit risk reflects a bank's poor asset quality. In other words, banks with an increased proportion of high risk loans have a higher propensity of loan defaults, which consequently effects their performance (Cooper, Jackson, & Patterson, 2003). Literature suggests that bank

performance is positively associated with asset quality. Following Beck, Demirgüç-Kunt, et al. (2013), we used loan loss reserves and loan loss provisions, scaled by gross loans, as proxies to measure asset quality. Both measures reflect poor asset quality.

Based on the above arguments, *we hypothesize that the profitability of Islamic banks decreases with an increase in credit risk.*

Cost Efficiency: The cost to income ratio (CIR) is widely used as a major internal determinant of bank profitability (Djalilov & Piesse, 2016; Dietrich & Wanzenried, 2011; Athanasoglou et al., 2008; Kosmidou et al., 2005). This ratio is used as a measure of management's efficiency in controlling costs. Moreover, it provides information on bank improvements in communication, information and financial technologies (Almazari, 2014). Kosmidou et al. (2005), among others, describe cost as the operational overheads of a bank and argue that a lower cost to income ratio reflects better management efficiency, which leads to increased profitability. Similarly, discussing developing economies, Sufian (2011), demonstrates the impeding effects of operational expense on bank profitability. However, Molyneux and Thornton (1992) found a positive relationship between staff expense and bank profitability. The authors reason that higher payroll expenditures resulted in more satisfied staff and ultimately to higher firm profits.

Since the improved management of operational expenses will increase efficiency, which is associated with higher profitability, *we expect a negative relationship between cost to income ratio and profitability of Islamic banks.*

3.4.2.2 Industry – specific Factors

Market Concentration: The degree of concentration or level of competition, as an indicator of banking industry structure, is commonly used in recent studies to determine profitability (Djalilov & Piesse, 2016; Dietrich & Wanzenried, 2011, 2014; Mirzaei, Moore, & Liu, 2013; Athanasoglou et al., 2008). Following the literature, we take assets of the three largest banks scaled on the total assets of the industry (3_CONC), as a measure of market concentration.

According to structure conduct performance (SCP) hypothesis, banks can earn higher profits in a concentrated market because of monopolistic pricing and low competition levels, irrespective of bank efficiency. Whereas, the efficient structure (ES) hypothesis conjectures that market concentration, with the bank-specific attributes, such as better management efficiency, allows banks to increase their market share, which in turn leads to higher market concentration (Djalilov & Piesse, 2016). This implies that banks in a concentrated market are more efficient and thus more profitable.

Based on the above arguments, *we assume a positive relationship between market concentration and bank profitability.*

3.4.2.3 Macroeconomic Factors

Economic Growth: The sensitivity of financial institution performance, with respect to cyclical output variations, within an economy is well established in the literature (Dietrich & Wanzenried, 2014; Bolt, Haan, Hoeberichts, Oordt, & Swank, 2012; Athanasoglou et al., 2008; Kosmidou, 2008). Gross domestic product (GDP) is commonly used as a macroeconomic determinant of bank profitability, which aggregates the overall economic activity of a country and GDP growth, is the reflection of its annual change. In their studies on profitability determinants in Islamic banks Bashir (2003), Wasiuzzaman and Tarmizi (2010) and Zarrouk, Jedidia, and Moualhi (2016) suggest a positive correlation between GDP growth and bank profitability. The economic upswings encourage banks to increase their lending activities, charge higher margins and improve their asset quality, consequently increasing their profits (Athanasoglou et al., 2008; Kosmidou, 2008). In contrast, loan demands are expected to decrease, along with an increase in the credit risk, due to deteriorated loan quality and high market volatility during economic downturns. This leads to a decline in bank' profitability (Bolt et al., 2012).

We, therefore hypothesize a positive relationship between economic growth and the profitability of Islamic banks.

Inflation: The annual change in consumer price index (CPI), which is used as a proxy of inflation, is another important macroeconomic factor to determine bank profitability. Staikouras and Wood (2011) explain that inflation may affect bank profitability either directly (in terms of wages and other operating expenses), or indirectly (through changes in interest rates and asset prices). However, the effect of inflation on bank performance depends on how well the inflation rate is anticipated by managers (Perry, 1992). When inflation is fully anticipated, bank profitability increases through appropriate adjustment of their interest rates, which results in an increase in their revenues faster than costs. However, if inflation is unanticipated, it adversely effects bank profitability as banks may be slow to adjust their interest rates, which results in a faster increase in their costs, relative to their revenue. The relationship between the inflation rate and bank profitability is inconclusive, as evident from the previous empirical literature. Most studies have found a positive and significant relationship between inflation and the profitability of Islamic as well as conventional banks (see for example, Wasiuzzaman & Tarmizi, 2010; Athanasoglou et al., 2008; Asutay & Izhar, 2007; Haron, 2004; Demirgüç-Kunt & Huizinga, 1999). However, Khrawish (2011) and Kosmidou (2008) found a negative relationship in Greece and Jordan, respectively. In contrast, Saad and El-Moussawi (2012) and Naceur (2003) did not identified any significant relationship between inflation and net interest margin. Therefore, the relationship between inflation and bank profitability is considered ambiguous.

The regression model (equation 3.2) is extended in equation 3.7, to reflect the explanatory variables, as discussed in the most studies on Islamic banking performance (see for example, Alharbi, 2017; Abduh & Idrees, 2013; Hassan & Bashir, 2003). The selected variables are included in equation 3.2 to estimate the effect of maturity transformation risk on Islamic banks' performance, while controlling for other internal and external variables.

$$P_{it} = \partial_1 P_{it-1} + \delta_1 NSFR_{it} + \vartheta_1 CAR_{it} + \vartheta_2 NII_{it} + \vartheta_3 SIZE_{it} + \vartheta_4 LLRTL_{it} + \vartheta_5 CIR_{it} + \phi_1 3\_CONC_{jt} + \lambda_1 GDP_{jt} + \lambda_2 CPI_{jt} + \varepsilon_{it} \quad (3.7)$$

Table 3.3 defines all of the selected variables included in equation 3.7, along with their expected signs.

Table 3.4. Definition of Variables in Maturity Transformation Risk and Bank Profitability Model (Equation 3.7)

Category	Variables	Description/ Calculation	Exp. Sign
Dependent Variable			
Return on Average Asset	ROAA	Ratio of net income to average total assets.	
Return on Average Equity	ROAE	Ratio of net income to average total equity.	
Independent Variables			
Bank-specific			
Maturity Transformation Risk	NSFR	Net stable funding ratio is defined as the ratio of available amount of stable funding to required amount of stable funding	-
Solvency	CAP	Ratio of total regulatory capital to total assets.	+
Income Diversity	NII_TA	Non-interest income scaled to total assets	+
SIZE	ln_TA	Natural log of total assets	+
Asset Quality	LLR_TA	Ratio of loan loss reserves to total loans.	-
Cost Efficiency	CIR	Cost to income ratio	-
Industry-Specific			
Market Concentration	3_CONC	Ratio of assets of a country's three largest banks to total banking industry assets	+
Macroeconomic			
Economic Growth	GDP	Annual percentage growth in GDP	+
Inflation	CPI	Year-on-year change in consumer price index	?

Source: Author's calculations, Bloomberg (2006 – 2015), banks' annual reports, World Bank's World Development Indicators.

3.5 Justification for Variable Selection in Maturity Transformation Risk and Bank Stability Model

This section justifies the dependent variable, which function as a proxy for bank stability, as well as the various bank-specific, industry-specific and macroeconomic variables as determinants of bank stability. Further, this section hypothesizes the relationship between the selected explanatory variables and bank stability, with the expected signs.

3.5.1 Measure of Bank Stability

Bank stability is often measured as the distance from default. According to Boyd and Runkle (1993), Hannan and Hanweck (1988) and Boyd and Graham (1986), firm insolvency occurs when losses exceed capital. Subsequently, the probability of insolvency is defined as the probability that losses $(-\pi)$ exceed equity (e), which can be expressed as follows:

$$\boldsymbol{p[e < -\pi] = p[car < -roaa]} \quad \textbf{(3.8)}$$

where $roaa$ is the return on average assets and car is the capital share in assets.

De Nicolo (2001) suggests that this probability satisfies the Bienaymé–Chebyshev inequality as follows:

$$\boldsymbol{p[car < -roaa] \leq \frac{\sigma(roaa)^2}{(roaa + car)^2} = \frac{1}{Z^2}} \quad \textbf{(3.9)}$$

The Z-score, which is widely accepted in recent banking literature as a measure of the safety and soundness of both Islamic and conventional financial institutions (Köhler, 2015; Beck, Demirgüç-Kunt, et al., 2013; Čihák & Hesse, 2010; Rahman, 2010), is an inverse proxy for the bank's probability of default. It is the only account-based risk measure that combines profitability, leverage and volatility. The Z-score is calculated based on the formula given by Lepetit and Strobel (2013) as follows:

$$Z = \frac{car + \mu_{(roaa)}}{\sigma_{(roaa)}} \quad \textbf{(3.10)}$$

where car is the capital to asset ratio, $\mu_{(roaa)}$ is the expected of return on assets and $\sigma_{(roaa)}$ is the volatility in return on assets for each bank. The mean of return on assets and volatility in return on assets are computed over the full sample period and are combined with the current value of capital. The resulting Z-score measures the distance of the likely occurrence of a bank default event, in terms of standard deviations of return on assets, which suggests that a higher Z-score reflects higher bank stability. A higher Z-score can be attained through an increase in profitability, an increase in equity and stable returns that will result in a more stable bank with a decreased overall risk. Some of the previous studies apply Z-score to capture the overall financial stability (Lee & Hsieh, 2014), whereas others use this to measure the probability of individual banks defaulting (Beck, Demirgüç-Kunt, et al., 2013; Čihák & Hesse, 2010; Laeven & Levine, 2009). Since the Z-score's distribution is highly skewed, we follow Schaeck and Cihák (2014) and Laeven and Levine's(2009) recommendations to use log transformed Z-scores (ln_Zscore) as a measure of bank stability in our study, in order to avoid of the effect of extreme values.

3.5.2 Explanatory Variables

Prior empirical studies on the soundness of the Islamic banking sector have classified stability determinants into broad categories of financial, structural and macroeconomic variables (Ashraf et al., 2016; Abedifar, Molyneux, & Tarazi, 2013; Beck et al., 2013; Čihák & Hesse, 2010). Following the previous literature, we specify a set of bank-specific, industry-specific and macroeconomic variables to assess their potential impact on the stability of Islamic banks, as follows.

3.5.2.1 Bank – specific Factors

Maturity Transformation Risk: We are interested in determining the impact of contemporary liquidity regulations on the stability of Islamic banks, as the importance of the banks' role in liquidity and maturity transformation has emerged during the recent 2018 global financial crisis (Acharya & Mora, 2015; Berger & Bouwman, 2009). To fulfil this objective, we introduced the NSFR variable into our bank stability model. The NSFR is a micro prudential structural measure which reflects the long-term funding stability of banks. The higher NSFR

ratio is achieved when available stable funds are more than the required stable funds, which implies that banks are able to meet their liquidity obligations when the need arises. Conversely, if the required amount of stable funding exceeds the available funding, this may expose banks to maturity transformation risk (or a mismatch in the maturities of assets and liabilities). This mismatch may cause customer panic or lead to a run on banks (see for example, Diamond and Dybvig, 1983). Thus, we use the NSFR to account for the classic 'bank-run' risk.

Based on the above arguments, *we hypothesize that inclusion of NSFR as a regulatory requirement is positively associated with the overall financial soundness of Islamic banks.*

Bank Capital: A wide range of theoretical literature has argued the salutary effect of capital on bank survival probability (Acharya, Mehran, & Thakor, 2016; Allen, Carletti, & Marquez, 2011; Mehran & Thakor, 2011; Holmstrom & Tirole, 1997). Accordingly, these models suggest that an increase in equity provides banks with incentive to monitor their borrower relationships. Moreover, it also attenuates investments in more risky assets, thereby lowering the credit risk and subsequently the risk of default. This implies that higher capital improves the likely probability of bank stability. On the contrary, while advocating the risk-absorption hypothesis, Bhattacharya and Thakor (1993) and Coval and Thakor (2005), have argued that since capital provides a cushion to absorb losses, increasing equity shares may be counterproductive under certain conditions; it perversely increase the degree of bank risk exposure. Beck, Demirgüç-Kunt, et al. (2013) also support the argument that capital increases the bank's survival probability. They found that Islamic banks with higher equity are more competitive and thus tend to be more stable.

We, therefore hypothesize a positive relationship between capital and Islamic banks' stability.

Efficiency: We utilized cost to income ratio to control for operational efficiency in our bank stability model. It is a measure which explains the management quality in terms of controlling operational overheads. In support of Berger and DeYoung (1997) and Kwan and Eisenbeis

(1997), Chiaramonte, Poli, and Oriani (2015) suggest that inefficient banks are more prone to higher risks, as cost inefficiency induces the moral hazard problem, since poorly run banks tend to invest in more risky assets in order to improve their profitability. Abedifar et al. (2013) and Čihák and Hesse (2010) contested that cost inefficiency has an adverse effect on the solvency of Islamic banks. In their comparative study on Islamic and conventional banks, Beck, Demirgüç-Kunt, et al. (2013) concluded that Islamic banks generally possess lower cost efficiency and are less stable than conventional banks.

Accordingly, higher cost inefficiency is expected to be negatively associated with the financial stability of Islamic banks.

Income Diversification: We also include the ratio of non-interest income to total assets to control for the income diversification effect in Islamic banking stability. According to Abedifar et al. (2013), this ratio reflects the deviation of management focus of income generation from loan activities towards sources of non-traditional banking activities. The impact of income diversification on bank stability has produced mixed results. Abedifar et al. (2013) and Čihák and Hesse (2010) found that increasing reliance on non-traditional banking activities significantly reduce the stability of Islamic banks. Likewise, Chiaramonte et al. (2015) Lepetit et al. (2008) and Mercieca, Schaeck, and Wolfe (2007) also reveal that the probability of bank default risk increases with an increase in shares of non-interest income. On the contrary, Köhler (2013, 2015) shows that the stability of retail-oriented banks benefit from income diversity. Similarly, Ashraf et al. (2016) also found that the risk of default in Islamic banks is significantly reduced by increasing shares of non-interest income. Demirgüç-Kunt and Huizinga (2010b) concluded a non-linear relationship between diversification and insolvency risk, with some gains at low level of income diversity. Moreover, DeYoung and Torna (2013), contested that the effect of diversification on bank stability varies, from the choice of non-traditional income sources. They explained that pure fee-based income can decrease the probability of bank default, whereas income generated form asset securitization, investment in venture capital and other risky non-traditional banking activities are more volatile, and thus have an adverse effect on bank stability.

Since Islamic banking is still in its infancy stage, we assume that they rely mainly on traditional banking activities for revenue generation and are not involved in risky investments, *therefore, we hypothesize that income diversification will have a positive impact on their stability*.

Asset Quality: Another important explanatory variable included in our model is asset quality, which determines a bank's financial soundness. Conventionally, banks are involved in financing activities and loans are the main constituents of a bank's assets portfolio. However, loans are also considered to be the most risky assets, since an increase in loans also exposes banks to the risk of borrowers' default (Demirgüç-Kunt & Detragiache, 1998). This leads to an increase in overall bank risk and subsequently, destabilizes the banking system. Trad et al. (2017) also show that better asset quality positively contributes to the stability of Islamic banks. Following Beck, Demirgüç-Kunt, et al. (2013), we employ the ratio of loan loss reserves to total assets and loan loss provisions to total assets, to examine the effect of asset quality on bank stability. According to Abedifar et al. (2013) loan loss reserve denotes the management's assessment of the overall loan portfolio quality, and the loan loss provision is the cost incurred by the bank after adjusting the loan loss reserve or a loan default. Both measures correspond to low asset quality; i.e., higher ratios imply increased risk of loan default, which leads to overall financial instability.

We, therefore hypothesize that better asset quality is positively associated with increased bank stability.

Size: To account for the possible effect of scale (in)efficiencies on solvency, we have included the logarithmic transformation of total assets (ln_TA) as a proxy of bank size, in our stability model. Smirlock's (1985) earlier model explains the stability gains of larger banks through higher degrees of product and loan diversification. Consistently, De Haan and Poghosyan (2012) found that size is positively linked with bank stability, as larger banks show a decline in earnings volatility. Moreover, Triki, Kouki, Dhaou, and Calice (2017) also find evidence of a positive impact of size on bank solvency. According to Mesa, Sánchez, and Sobrino (2014), an increase in bank size results in higher efficiency gains, which ultimately leads to increased

bank stability. On the contrary, Bhagat, Bolton, and Lu (2015) argue that large banks may find incentives to take excessive risk when they perceive themselves to be "too big to fail." This implies that an increase in size leads to an increase in a bank's overall risk, which consequently increases the probability of bank default. While determining the stability of Islamic banks, Čihák and Hesse (2010) found that small Islamic banks are more stable, as compared to larger Islamic banks. They identified credit risk management as the key challenge for Islamic banks when they expand. In contrast, Trad et al.'s (2017) recent study found evidence of bank capital and size as key determining factors of increased profitability and stability of Islamic banks. Similarly, Ibrahim and Rizvi (2017) also found evident to support larger Islamic banks in terms of the size – stability relationship.

Therefore, we assume that the stability of Islamic banks increase with an increase in their size.

3.5.2.2 Industry – specific Factors

Concentration ratio: We include 3_CONC in our stability model to measure banking sector concentration. This ratio is calculated as the sum of assets of the three largest banks scaled by the industry's total assets. We employed this ratio to capture the effect of cross-country variation in financial stability caused by differences in market concentration. The effect of market concentration on stability cannot be determined a priori. Both the economic theory and empirical literature remain inconclusive on the concentration – fragility/stability relationship. According to the "concentration – stability" framework, banks with greater market power can reduce the financial fragility in a concentrated market through increased profitability and higher "capital buffers," which allow them to absorb macroeconomic and liquidity shocks (Boyd, De Nicoló, & Smith, 2003). Berger, Klapper, and Turk-Ariss (2010) and Schaeck and Cihak's (2012) studies provide support for this argument. Moreover, larger banks are more inclined towards "credit rationing," which enable them to maintain a higher quality set of assets, thus leading to greater financial stability (Boot & Thakor, 2000). Similarly, Allen and Gale (2004) argued that it is easier to monitor a few large banks in a market. This results in more efficient supervision and therefore declining risks of overall financial contagion. In support of the concentration – stability hypothesis, Beck, Demirgüç-Kunt, and Levine (2006)

and Schaeck, Cihak, and Wolfe (2009) provide strong empirical evidence that financial crisis is less likely to occur in a more concentrated financial system. In contrast, the "concentration–fragility" hypothesis assumes that the implicit government protection induces the moral hazard problem in banks with greater market power, when they consider themselves to be "too big to fail," and invest in more risky investments which leads to a higher probability of bank insolvency (Mishkin, 1999). Moreover, the higher interest rate charged by monopolistic banks coerce borrowers to invest in risky investments, which may increase the likelihood of loan defaults, thus adversely affecting bank stability (Boyd & De Nicolo, 2005). Fu, Lin, and Molyneux (2014) reveal the repercussions of greater market concentration. They argue that it results reduced charter value and increased bank risk exposure, and that there is a higher probability of financial insolvency. While comparing both Islamic and conventional banking systems in Middle Eastern countries, Mirzaei (2011) also concluded that high market concentration is negatively associated with the financial stability of Islamic banks.

3.5.2.3 Macroeconomic Factors

Economic Freedom: Among the macroeconomic determinants of financial stability, economic freedom has recently gained the attention of researchers (see for example, Asteriou, Pilbeam, & Tomuleasa, 2016; Moghadam, 2013; Sufian & Habibullah, 2014, 2010). According to Asteriou et al. (2016), economic freedom can positively influence banking performance in terms of both profitability and stability, through encouraging lending and greater diversification. In this way, banks can attain a better risk-return frontier, which leads to increased efficiency and hence stability. They further argue that greater economic freedom provides a better business environment, which in turn leads to higher economic growth. Moreover, Miller, Holmes, and Feulner (2013) found a positive association between economic freedom and a higher level of real per capita income, which suggests an increased demand for banking services in those countries. While explaining the economic freedom – stability relationship, Sufian and Habibullah (2010) contested that the overall financial efficiency of Malaysian banks improves with more economic freedom. Baier, Clance, and Dwyer (2012) also revealed a decline in the probability of financial crises with increased levels of economic freedom. Following the previous studies (Asteriou et al., 2016; Sufian & Habibullah, 2010, 2014), we utilized the index of overall economic freedom (Eco_F) from the Heritage

Foundation in our stability model.[9] This index ranges from 0 to 100 (with 100 being the highest freedom value). It is composed of ten freedom indices which are equally weighted. We have also included the four freedom indices; business freedom (Bus_F), monetary freedom (Mon_F), financial freedom (Fin_F) and freedom from corruption (Cor_F), to gain further insight into the impact of the freedom index on the stability of Islamic banks (adopted from Sufian and Habibullah (2014)). We assume that economic freedom is positively associated with the financial soundness of Islamic banks.

Economic Growth: To capture the impact of the state of an economy on its financial institutions' operations, we have also considered the economic growth variable as a key macroeconomic determinant of financial stability. The Gross Domestic Product (GDP) growth rate is commonly used in banking literature as a proxy for economic growth (see for example, Köhler, 2015; Diaconu & Oanea, 2014; Bourkhis & Nabi, 2013; Sufian & Habibullah, 2012; Čihák & Hesse, 2010). It represents movements in the business cycle in a country or the fluctuations in overall economic activity, which are both likely to affect the performance of its financial system. In their study on Chinese banking sector, Sufian and Habibullah (2012) argued that the asset quality deteriorates and credit risk is likely to increase during economic downswings. These result in increased bank risks and thus to financial insolvency. Similarly, Köhler (2015) found strong empirical evidence of the positive influence of GDP growth rate and GDP per capita on bank stability. Diaconu and Oanea (2014) provide support for the argument that banks enjoy greater stability during economic upswings. Whereas, Karim, Al-Habshi, and Abduh (2016), Bourkhis and Nabi (2013), and Čihák and Hesse (2010) were unable to find any relationship between economic growth and the stability of Islamic banks. Since, during periods of economic growth banks are encouraged to increase their lending activities, they can charge even higher interest rates and are able to increase their asset quality (Sufian & Habibullah, 2012). Thus, we assume a positive influence between the GDP growth rate and the stability of Islamic banks.

[9] 2016 Index of Economic Freedom Retrieved from https://www.heritage.org/international-economies/report/2016-index-economic-freedom-yet-more-evidence-free-trades-benefits

Inflation: We have also included yearly change in consumer price index (CPI) as a measure of inflation in our stability model to control for omitted variable bias. It reflects the price volatility in an economy. Some of the previous studies suggest that price stability is a prerequisite for the financial soundness of the banking system and that price and financial stability reinforce each other in the long run (Bordo, 2009; Bordo & Wheelock, 1998; Schwartz, 1995). Calomiris and Gorton (1991) found that the likelihood of financial crisis increases significantly because of high inflationary pressures during recessions. Accordingly, banks are inclined to charge higher interest rates during times of increased price volatility, consequently increasing their insolvency risk (Akram & Eitrheim, 2008). Moreover, Hardy and Pazarbaşioğlu (1999) and Demirgüç-Kunt and Detragiache (1998) explain that countries with high levels of inflation are more prone to financial crises. On the contrary, Leijonhufvud (2007), White (2006) and Rhaguram (2005), have argued that the stable monetary policy can trigger financial crisis, as price stability can encourage economic agents to take greater risks in search of high returns. Besides, Boyd, Levine, and Smith (2001) found a non-linear negative stability – inflation relationship. Furthermore, Karim et al. (2016), Bourkhis and Nabi (2013), and Čihák and Hesse (2010) were all unable to determine the impact of inflation on the stability of Islamic banks. Based on the above arguments, we hypothesize that stable inflation at lower levels can increase financial distress for Islamic banks.

The extended form of equation (3.3) estimates the effect of maturity transformation risk on the stability of Islamic banks, while controlling for other bank specific, industry specific and macroeconomic factors is given as follow:

$$Z_{it} = \gamma_1 Z_{it-1} + \delta_1 NSFR_{it} + \vartheta_1 CAR_{it} + \vartheta_2 CIR_{it} + \vartheta_3 NII_{it} + \vartheta_4 LLRL_{it} + \vartheta_5 SIZE_{it} + \phi_1 3\_CONC_{jt} + \lambda_1 GDP_{jt} + \lambda_2 CPI_{jt} + \varepsilon_{it} \quad \textbf{(3.11)}$$

Table 3.5. Definition of Variables in Maturity Transformation Risk and Bank Stability Model (Equation 3.11)

Category	Variables	Description/ Calculation	Exp. Sign
Dependent Variable			
Stability	Z_score	Natural log of sum of equity ratio and return on average assets scaled by standard deviation of return on average assets. $Z = \ln(\frac{car + \mu_{(roaa)}}{\sigma_{(roaa)}})$	
Independent Variables			
Bank-specific			
Maturity Transformation Risk	NSFR	Net stable funding ratio is defined as the ratio of available amount of stable funding to required amount of stable funding	-
Bank Capital	CAP	Ratio of total regulatory capital to total assets.	+
Cost Efficiency	CIR	Cost to income ratio	-
Income Diversification	NII_TA	Non-interest income scaled to total assets	+
Asset Quality	LLR_TA	Ratio of loan loss reserves to total loans.	-
SIZE	ln_TA	Natural log of total assets	+
Industry-Specific			
Market Concentration	3_CONC	Sum of assets of three largest banks scaled by total assets of the industry	?
Macroeconomic			
Economic Freedom	Eco_F	Index of economic freedom	+
Economic Growth	GDP	Annual percentage growth in GDP	+
Inflation	CPI	Year-on-year change in consumer price index	-

Source: Author's calculations, Bloomberg (2006 – 2015), banks' annual reports, World Bank's World Development Indicators, The Heritage Foundation (2016).

3.6 Selection of Estimation Technique

To incorporate the temporal effects of the dependent variables, this study applies the dynamic panel data model, which uses a one period lag of the dependent variables as explanatory variables. The introduction of these lags is crucial to control for the dynamics of the process.

Consider the following general equation for dynamic panel data model

$$\boldsymbol{y_{it} = \gamma y_{it-1} + \beta X_{it} + \varepsilon_{it},} \qquad \text{where } \boldsymbol{\varepsilon_{it} = a_i + \nu_{it}} \qquad \textbf{(3.12)}$$

$i = 1, \ldots, N$ (cross-sectional observations), $t = 1, \ldots, T$ (time periods), X_{it} are the regressors, a_i is fixed individual effects and ν_{it} has zero mean, constant variance and is uncorrelated across time and individual.

The empirical estimation of equation (3.12) by pooled ordinary least squares (OLS) disregards the panel structure of data and often results in upward-biased γ estimate of the lagged dependent variable y_{it-1} in the presence of unobserved fixed effects α_i (Bond, 2002). Moreover, the characteristics of the above specified models and proposed variables in equations (3.1, 3.2 and 3.3) potentially violate the classical assumptions underlying the OLS estimator in several aspects. First, among other assumptions of OLS, to yield unbiased, consistent and efficient estimates, data should be normally distributed with unknown mean and variance (Greene, 2003). However, Al-Jafari and Alchami (2014) note that distribution of financial data is generally skewed with large outliers, which violates this OLS assumption. Hence, using OLS to estimate parameters in a dynamic specification often yields inconsistent, biased and/or inefficient estimates. Another fundamental assumption of the OLS estimator is that all of the explanatory variables must be uncorrelated with the disturbance term and that the disturbances are homoscedastic and not correlated with the regressors. However, in the dynamic model specification, the explanatory variable y_{it-1} is correlated with the residual α_i since y_{it} is a function of α_i, which renders Generalized Least Squares (GLS) and OLS estimators biased and inconsistent. Similarly, Within Group (WG) estimators are also biased and inconsistent, as in the transformed model, while using variable differenced from mean [$y_{it} - \bar{y}_i = \gamma(y_{it-1} - \bar{y}_i) + \beta(x_{it} - \bar{x}_i) + (\nu_{it} - \bar{\nu}_i)$], the explanatory variable will become

endogenous i.e., $\bar{y}_i$ is correlated with $\bar{v}_i$ (Bond, 2002). In his seminal paper, Bond (2002) has suggested that the standard approach to overcome the issue of serial correlation or endogeneity is to estimate the equation through instrumental variables (IVs) regression. As he explains, these IVs are a set of variables that are correlated with other explanatory variables and are uncorrelated with the disturbance term.

There are various instrument variables estimation techniques one can use eliminate the correlation among the regressors and the residuals, including two-stage least squares (2SLS), maximum likelihood estimation, and the generalized method of moments (GMM).

The GMM estimator, also known as moment-estimators, are defined by minimizing some criterion function (Al-Jafari & Alchami, 2014). It is a robust estimation technique that does not necessarily involve information regarding the distribution of the residuals. The underlying assumption of GMM estimation is that there is no correlation among the disturbances and the instrument variables introduced in the model. Furthermore, the assumption of normality is relaxed in GMM, thus it can provide consistent estimates even in the presence of potential non-normal distribution of variables (Greene, 2003). The GMM estimator selects parameter estimates so that the correlations between instruments and disturbances are as close to zero as possible i.e., $E\left[\epsilon_t . Z_t\right] = 0$, where $Z_t = [1\sigma_{i,t-1}]$. Moreover, the GMM estimator can be robust to serial correlation and the heteroscedasticity of the unknown form, via selecting the appropriate weighting matrix in the criterion function (Greene, 2003).

The two most commonly applied GMM techniques are the Difference GMM estimator (Diff-GMM) as specified in Arellano and Bond (1991) and the System GMM estimator (Sys-GMM) as explained in Arellano and Bover (1995) and Blundell and Bond (1998). Roodman (2009b) explains that Diff-GMM estimation begins with the transformation of all the variables in the model through first-differencing to remove the unobserved fixed effects "α_i" in the disturbance term. Further, Arellano and Bond (1991) propose a test for the hypothesis that there is no second-order serial correlation for the disturbances of the first-differenced equation. This test is important because the consistency of the GMM estimator relies upon the fact that $E\left[\Delta v_{it}\, \Delta v_{it-2}\right] = 0$. The first-differenced equation is then estimated by using lags of potentially predetermined and endogenous explanatory variables. These lags are used as instrumental variables in the transformed equation. Hence, the Diff-GMM technique

overcomes the potential problem of endogeneity and autocorrelation by using lagged values of the independent variables as instruments. It also eliminates the unobserved heterogeneity in the error term (Ommeren, 2011).

However, Roodman (2009b) reports finite sample bias in Diff-GMM estimation, as first-differenced transformation magnifies variances in unbalanced panels. In addition, the coefficients estimated through Diff-GMM are rather weak when the lagged and current values of the potential endogenous variables are slightly correlated. In contrast, the Sys-GMM, as proposed by Arellano and Bover (1995) and Blundell and Bond (1998), uses instruments in levels, in addition to instruments in first-difference. It also has no singularities, and exhibits much smaller variances. Instead of differencing, this estimation technique instruments lagged dependent variable and any other potentially endogenous variables among the regressors with variables presumed uncorrelated with the fixed effects (Roodman, 2009b).

Based on the previous literature, we summarized the main advantages of Sys-GMM over Diff-GMM in the following points:

a) Baum (2006) and Roodman (2009a) contend that the Sys-GMM estimator is more efficient than Diff-GMM in variables that are "random walk," or close to be random-walk variables. Since the models used in our study include macroeconomic variables, which are known in economics for the presence of random walk statistical generating mechanisms, the Sys-GMM approach seems to be the best choice.
b) The Sys-GMM approach has a distinct advantage over Diff-GMM because it produces more efficient and precise estimates by improving precision and reducing the finite sample bias (Baltagi, 2008).
c) For an unbalanced panel data analysis, it is better to avoid Diff-GMM estimation, which tends to magnify variances over a significant range of parameter values (Roodman, 2009a).

Roodman (2009b) explains the validity and consistency of the model based on several choices within the System GMM estimator. One of these choices is the selection of either a one-step GMM or two-step GMM estimation procedure. The one-step estimator assumes the disturbance term to be independent and homoscedastic over time and cross-sections, while

these assumptions are relaxed in two-step estimation. Additionally, the standard variance-covariance matrix is robust to autocorrelation and heteroscedasticity (Arellano & Bover, 1995). In the second-step, the residuals of the first-step are used to construct the standard variance-covariance matrix. Monte Carlo simulations show that the two-step technique slightly increases the precision of the estimates, while making the standard errors to be severely downward biased, more common in small and finite samples (Baltagi, 2008). However, using the Windmeijer correction will result in robust two-step standard deviations (Windmeijer, 2005). Hence, our study follows a two-step procedure.

In conclusion, we utilize the two-step system GMM technique for dynamic panel specification, to overcome the issues of heteroscedasticity, potential endogeneity and autocorrelation between error component and the regressors (Roodman, 2009b). Originally, system GMM method was developed to improve the behaviour of difference GMM estimators when the autoregressive parameter $'\gamma'$ approaches unity, in which case, lagged levels of the dependent variable are weak instruments. Moreover, for robust standard errors, our study adopted Windmeijer correction. The GMM technique is preferred over OLS as it is more appropriate for large cross sections and small time periods. In addition, it does not require the data to follow the normality assumptions.

Chapter 4

Empirical Results and Discussion

4.1 Introduction

This chapter discusses the empirical estimation of the three dynamic panel data models. Section 4.2 discusses the descriptive statistics of the dependent and explanatory variables used in our regression models. Preliminary diagnostic tests for the regression models are discussed in Section 4.3. Section 4.4 presents the empirical results of the dynamic panel data analysis of "determinants of maturity transformation risk" model, followed by robustness checks and post estimation specification tests to validate the System GMM results. The empirical estimation of "maturity transformation risk and banks' profitability" model and "maturity transformation risk and banks' stability" model are presented in sections 4.5 and 4.6, respectively. Robustness checks are also conducted for each of these regression models, along with post estimation diagnostic tests, in order to validate our estimation results.

4.2 Initial Data Analysis – Descriptive Statistics

The main objectives of our study are to determine the factors influencing the maturity transformation risk in the Islamic banking sector, as well as the impact of maturity transformation risk on profitability and the stability of Islamic banks. Table 4.1 reports the summary statistics of the dependent and independent variables used in the regression models to address the research objectives.

4.2.1 Dependent Variables

Among the dependent variables used in our models, NSFR, with a mean value of 1.45, reveals that on average, Islamic banks maintained a minimum liquidity requirement under the new IFSB regulations (i.e. > 1) during the sample period (see Table 4.1). Besides, a minimum value of 0.81 shows that there are few banks which still need some balance sheet adjustments to meet these new regulatory requirements. FGR is also used as an alternative measure of maturity transformation risk in our analysis. The mean value of FGR is -22.45%, which shows the conservative financing approach of Islamic banks during the sample period. On average,

Islamic banks exhibit lower levels of liquidity creation with a higher dispersion of 29.07% and a minimum and maximum value of -114.85% and 55.28%, respectively (see Table 4.1).

ROAA, which is used as the main dependant variable in our "Maturity Transformation risk and Banks' Performance" model (equation 3.7), exhibits a mean value of 1.13% in our sample of Islamic banks, with a standard deviation of 2.15% and a minimum and maximum value of -9.79%, and a maximum of 13.21%, respectively. The average ROAA value shows that Islamic banks remain profitable during the sample period, however, the large gap between the minimum and maximum values for ROAA also reveals that there is a large difference in profitability among these banks. The mean value of alternative profitability measure (ROAE) is 8.56%, and also shows a large dispersion of 19.64%, that ranges from the highest value of 58.72% to the lowest of -173.51%, during the study period (see Table 4.1).

Natural log of Z-score (ln_Zscore) is employed as the stability measure in our "maturity transformation risk and bank's stability" model (equation 3.11). Table 4.1 shows the mean ln_Z-score of 2.77 with a dispersion of 0.99 and a minimum and maximum values of -2.98 and 6.26, respectively. This indicates that the Islamic banks are, on average, closed to the probability of default, based on the standard deviation of return on assets, during the study period. Moreover, the minimum value of -2.98 shows the instability of some Islamic banks during the sample period.

Table 4.1 Summary Statistics of Dependant and Independent Variables.

Categories	Models	Variables	MEAN	MEDIAN	SD	MAX	MIN	SKEWNESS	KURTOSIS
Dependent Variables	"Determinants of Maturity Transformation Risk" Model	$NSFR_{it}$	1.4496	1.2718	0.4863	3.8674	0.8086	2.4069	9.46
		FGR_{it}	-22.4532	-13.6514	29.0672	55.2819	-114.857	-0.8679	3.0693
	"Maturity Transformation Risk and Banks' Profitability" Model	$ROAA_{it}$	1.1255	1.0644	2.1472	13.2118	-9.7998	-0.0922	11.2122
		$ROAE_{it}$	8.5615	11.0308	19.6388	58.72	-173.51	-4.7069	36.5889
	"Maturity Transformation Risk and Banks' Stability" Model	ln_Zscore_{it}	2.7713	2.8225	0.9952	6.2648	-2.9853	-1.1276	9.5226
Bank Specific Variables		CAP_{it}	14.0083	11.2299	10.219	93.1355	3.2792	3.3433	19.3034
		$LRLATA_{it}$	8.5838	7.4002	6.4508	43.7711	0.1197	1.4546	6.1326
		$RLATA_{it}$	24.3065	22.1672	15.8128	76.9604	0	0.7277	3.2575
		$LLRTL_{it}$	3.8312	2.1689	6.2964	57.7954	0	4.5469	29.0046
		ln_TA_{it}	8.4594	8.5803	1.4276	11.8041	2.8418	-0.3908	3.3828
		NDD_{it}	13.2318	9.5413	14.9273	85.6817	0	2.3507	10.6181
		STB_{it}	11.0906	4.7877	15.2652	90.6189	0	2.4891	10.8749
		$NONII\_TA_{it}$	1.2434	1.0301	1.6649	13.6373	-4.405	2.2349	16.0948
		EFF_{it}	55.3373	47.5873	31.0231	264.9046	15.8123	2.5114	11.9739
Industry Specific Variables		MP_{it}	4.946	2.4	6.3993	36.8	0.01	2.3556	8.3175
		3_CONC_{it}	62.0631	57.65	19.1603	98.99	28.48	0.1619	1.9051
Macro-economic Variables		ECO_F_{jt}	63.028	62.95	7.2077	77.7	44.2	0.0202	2.1645
		$CORR\_F_{jt}$	42.7459	44	14.5892	77	20	0.199	2.0982
		$BUSS\_F_{jt}$	67.7216	68.6	9.9248	93.5	39.8	-0.2775	3.2373
		MON_F_{jt}	73.2171	72.65	6.1555	90.8	58.4	0.1908	2.4852
		FIN_F_{jt}	49.0598	50	16.3988	90	20	0.6497	3.5691
		GDP_{jt}	4.9589	4.9688	3.778	26.1703	-7.0761	1.0939	10.1012
		INF_{jt}	5.3207	4.4964	3.9573	20.2861	-4.8633	0.9313	4.3814

Source: Author's calculations using Stata (v 14.0) software.

All variables are defined in Tables 3.2, 3.3 and 3.4.

4.2.2 Explanatory Variables

Among the explanatory variables, the average CAP value of 14.01% indicates that Islamic banks are well capitalized. However, the high standard deviation value of 10.22% and a minimum value of 3.28% in particular, shows excessive reliance of some Islamic banks on more unstable sources of funding. Regarding the composition of liquid assets, Table 4.1 shows that, on average, Islamic banks hold fewer shares of LRLA in total assets (8.58%) than RLA (24.31%). The results reveal that during the sample period, Islamic banks held on average 24.31% of their assets in trading securities and other long-term investments, which are relatively difficult to be collateralized or converted into cash compared to investment in short-term government securities. The motivation behind this may be the higher returns associated with these assets while still maintaining enough liquidity to meet obligations when due.

The credit risk, measured as loan loss reserves of the sample banks, is 3.83% of total loans on average, with a minimum and maximum value of 0% and 57.79% respectively. The results show a high variation (6.29%) in these banks during the study period. The mean value of bank size (ln_TA) is 8.46 represents a small dispersion in data with a standard deviation of 1.43% and minimum and maximum values of 2.84 and 11.80, respectively (see Table 4.1). A low average value of NDD (13.23%) suggests that Islamic banks rely more on core deposits than on external funding sources during the study period. However, the high variation of 14.92% and minimum and maximum values of 0% and 85.68% respectively, suggests that some Islamic banks are more inclined towards market funding sources to fund their assets or to fulfil liquidity obligations. As an alternative, the measure of external funding sources, STB also exhibit a low mean value of 11.09% with a high dispersion of 15.26% and minimum and maximum values of 0% and 90.61%, respectively.

Table (4.1) shows the average share of the non-interest income is 1.24% of total assets of the banks during the sample period, with a standard deviation of 1.66%. It varies from -4.40% to a maximum of 13.64%. This low share of non-interest income shows that Islamic banks generate income from traditional banking activities. Besides, the high average value of EFF (55.34%) suggests that the sample Islamic banks are not managing their overhead costs efficiently to generate revenue during the study period.

Moving on to the industry specific variables, the mean value of MP is 5.11%. This reveals that the share of total assets of an Islamic bank in a country is quite low. One possible explanation could be the infancy stage of Islamic banking in many of the sample countries and that the Islamic banks are relatively young in comparison to their conventional counterparts. Another reason could be due to the presence of a large number of banks. The sample banks are from emerging and developing countries (whose capital markets are undeveloped) and they are the main source of financing. Moreover, the high mean value of 3_CONC (62.06%) also shows that the banking industry in the sample countries are more concentrated, with fewer large banks holding a maximum market share in these economies.

The macroeconomic indicators record an average yearly economic growth (GDP) of 4.95% during the sample period and an average annual increase in consumer price index (INF) of 5.32%. The mean score of the overall economic freedom index (ECO_F) remain at 63.02 during the study period, with a dispersion of 7.21 points and a minimum and maximum index value of 77.7 and 44.2, respectively (see Table 4.1). This implies that the Islamic banks are operating in moderately free economies and that the state or government interfere less with individual autonomy. The less prevalent rule of law during the study period is evident from the low mean score of freedom from the corruption index (CORR_F) of 42.74, which implies that the sample Islamic banks are operating in economies with relatively high corruption levels. A possible reason could be the inefficient government regulations in these countries or the imposition of which limit business activities. These include bureaucratic decision making and high transaction costs, both of which attracts bribery and encourage illicit economic interactions. With respect to the regulatory efficiency, the business freedom index (BUSS_F) records a mean score of 67.72, which shows that the entrepreneurs are moderately free in their business conduct during the sample period. Similarly, the monetary freedom index (MON_F) exhibits a high mean score of 73.21 with a small variation of 6.15 points. The minimum and maximum values of 58.4 and 90.8 respectively, suggest that the sample countries are mostly free from volatile inflationary pressures during the study period and that there is a low level of government interference in price determination. The financial freedom index (FIN_F) ranges from a minimum score of 20 and a maximum score of 90, and records an average value of 49.05 during the sample period (see Table 4.1). This shows that, on average, Islamic banks

operate in marginally suppressed economies, where the opportunities of diversified savings, credit, payment and investment services are less available to the customers.

4.2.3 Trend Analysis of Maturity Transformation Risk, Profitability and Stability in Islamic Banks

We measure the trend of maturity transformation risk, profitability and the stability of Islamic banks over the period of 2006 to 2015. Figures 4.1 and 4.2 shows the 10-year trend of maturity transformation risk in terms of NSFR and FGR in relation to Islamic banks during the sample period. One key point from these figures is that both NSFR and FGR show an overall decline during the study period. A possible explanation for this downward trend could be the impact of the 2008 global financial crisis on the economies in which these banks operate. In other words, Islamic banks' ability to maintain their funding liquidity was significantly reduced, which adversely affected their access to available stable funds. Consequently, the sample banks reduced their prime role of liquidity creation, which could be a possible explanation for the increased financing gap ratio (FGR) during the sample period.

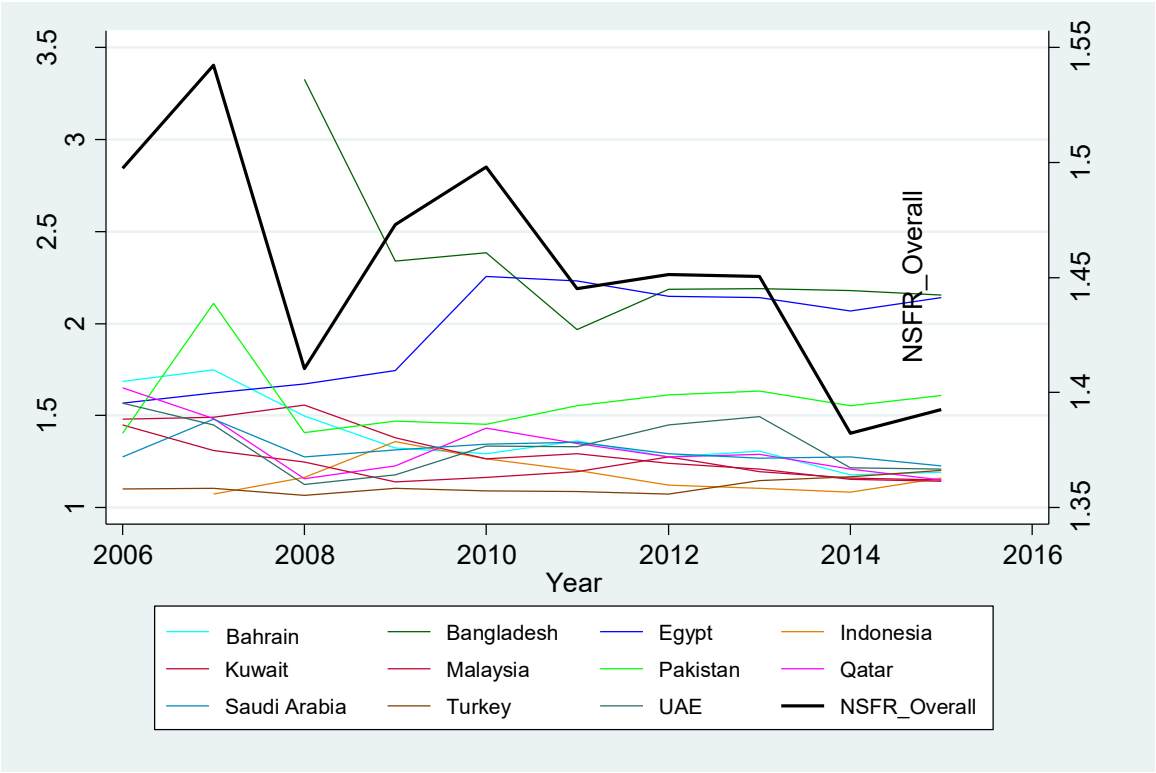

Figure 4.1 The 10 Year Trend of Overall Net Stable Funding Ratio (NSFR) in Islamic Banks

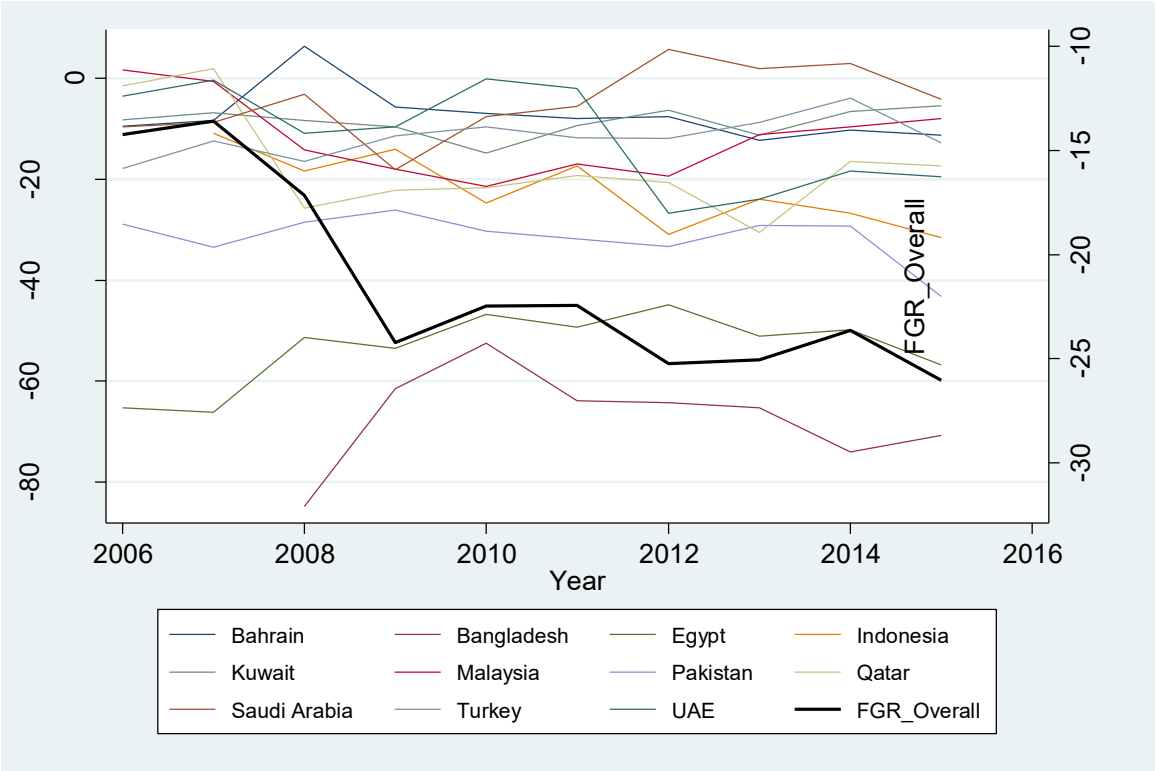

Figure 4.2 The 10 Year Trend of Overall Financing Gap Ratio (FGR) in Islamic Banks

Figures 4.3 and 4.4 also show a sharp decline in profitability (both ROAA and ROAE) in our sample Islamic banks during the crises period. It reached its lowest level in the year 2009. However, from 2010 onwards, these banks show gradual improvements in their profitability levels. Figure 4.5 shows Islamic bank stability trends over the sample period. The overall trend of ln_Zscore shows that, on average, Islamic banks remain stable during the sample period with little or no instability as a result of external shocks (for example, 2007-08 global financial crisis).

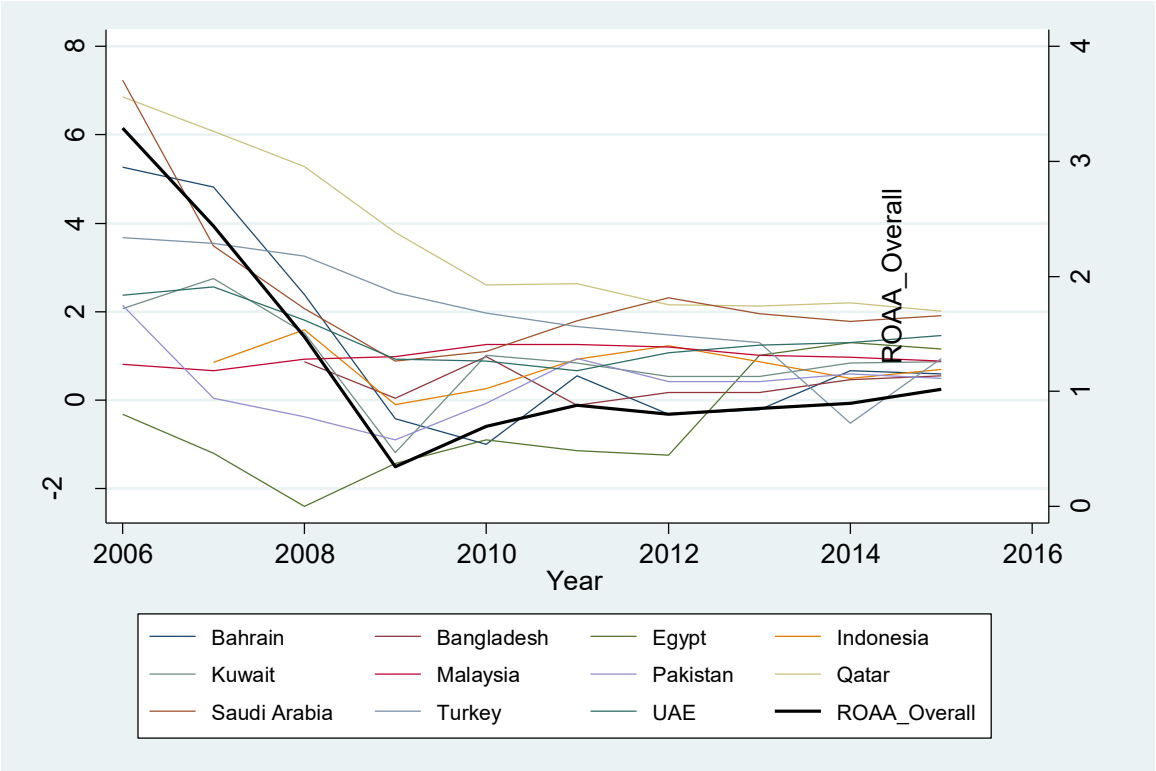

Figure 4.3 The 10 Year Trend of Overall Return on Average Assets (ROAA) in Islamic Banks

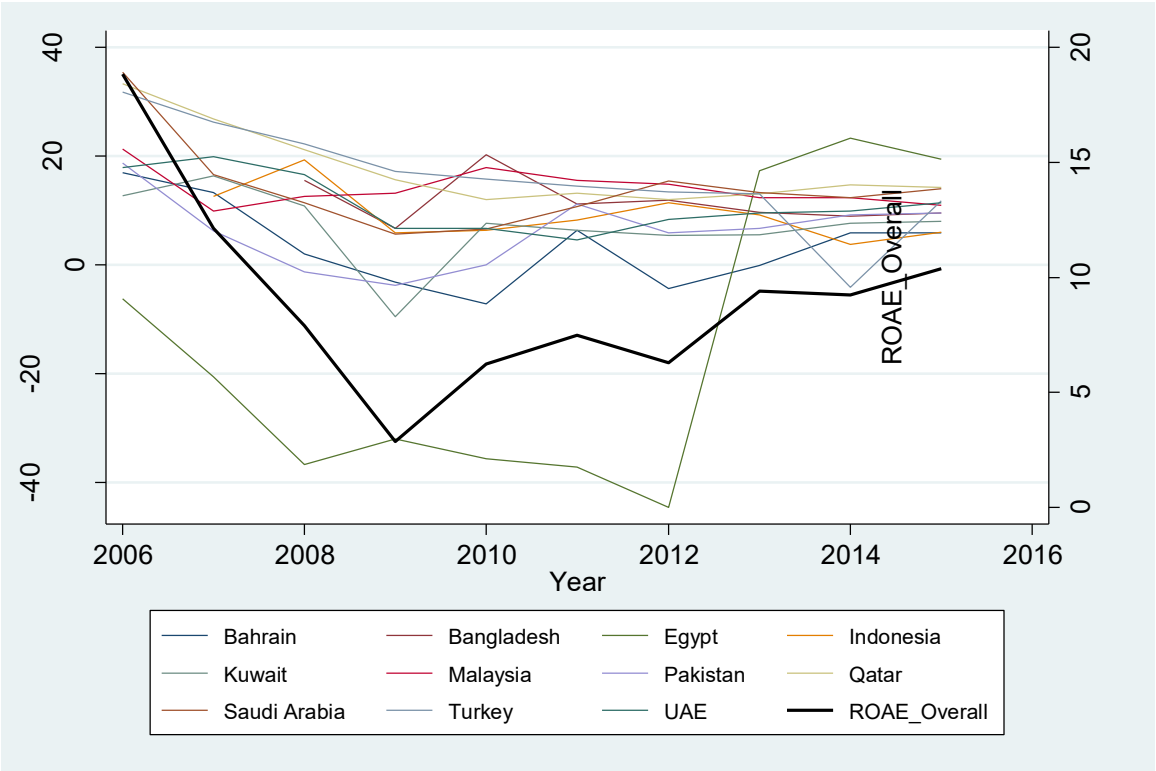

Figure 4.4 The 10 Year Trend of Overall Return on Average Equity (ROAE) in Islamic Banks

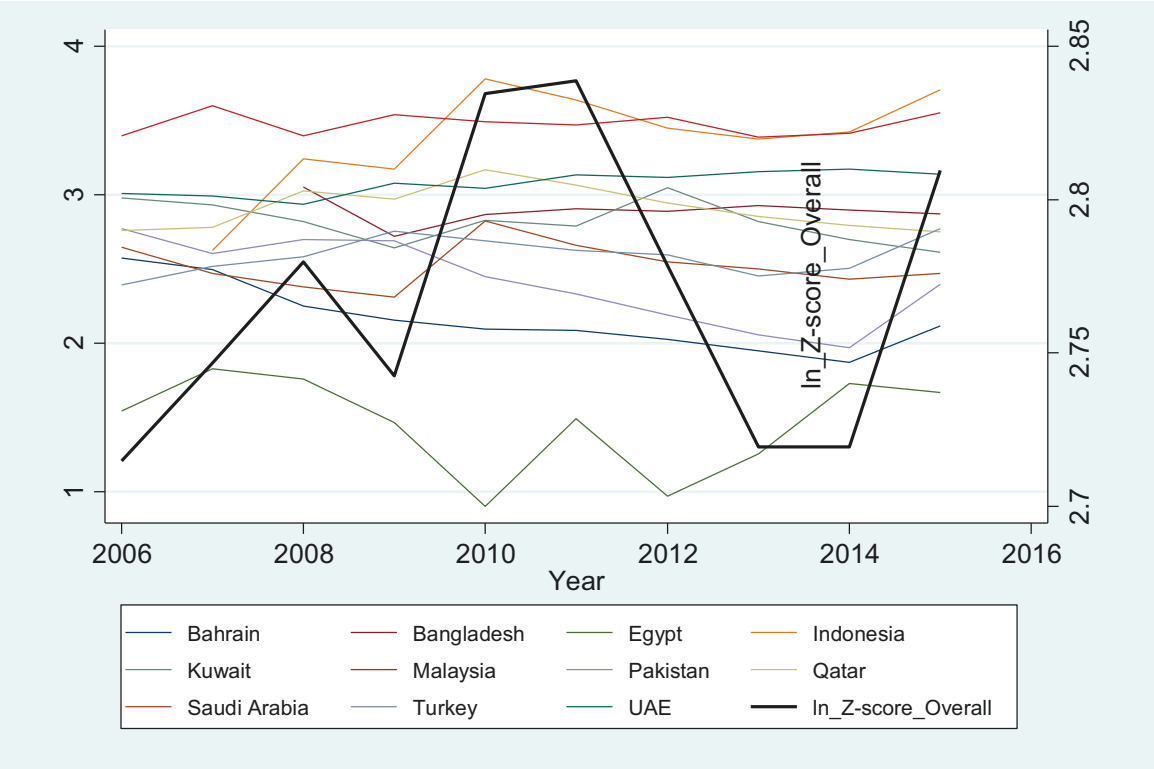

Figure 4.5 The 10 Year Trend of Overall Stability (ln_Zscore) in Islamic Banks

4.3 Pre-estimation Diagnostic Tests

This section explains the preliminary diagnostic tests which are essential for conducting our regression estimates.

4.3.1 Panel Stationarity Analysis

Maddala and Wu (1999) highlight the importance of data stationarity tests in panel data analysis. As Gujarati (2009) explains, a data is stationary when its mean and variance are constant over time. Covariance between the two time periods depends on the time separating observations and not the time at which they are observed. Generally, economic variables tend to exhibit a time trend and are therefore non-stationary; that is, the variables of interest have means, variances, and covariances that are not time invariant. The main reason to check data stationarity is to avoid spurious regression or obtaining apparently significant regression results from unrelated data when nonstationary series are used in a regression analysis.

This study applies the Fisher-type Augmented Dickey-Fuller (ADF) unit root test to assess whether the variables in our regression models are stationary (Choi, 2001). The motive behind selecting Fisher-type *p* test is that it is the only panel data unit root test which can incorporate the unbalanced nature of panel data with gaps. Moreover, the lag lengths of individual ADF tests can differ.

The following stochastic process y_{it} is produced by the first order autoregressive process as follows:

$$\boldsymbol{\Delta y_{it} = \alpha + \gamma y_{it-1} + \delta t + \sum_{j=1}^{k} \beta_{ij} \Delta y_{it-j} + \varepsilon_{it}} \qquad \textbf{(4.1)}$$

H_0: $\gamma = 0$; for all i

H_1: $\gamma < 0;\ i = 1,2, \ldots\ldots, N$

We assumed '$\gamma = \rho - 1$', however the lag order for the difference term allows ρ_i to have different values across the banks. The null hypothesis of a unit root is rejected if $\rho < 1$ in favour of the alternative that the variable is stationary. Both, inverse chi-square and modified chi-square test statistics of unit root test for all the variables included in our three regression models are reported in Appendix Table B.1. The test results obtained strongly reject the null hypothesis, and thus provide no evidence of unit root in any of the variables. Hence, all the variables are stationary.

4.3.2 Panel Correlation Analysis

One of the assumptions of the classical linear regression model (CLRM) is that there should be no multicollinearity among the explanatory variables or regressors included in the regression model (Gujarati, 2009). The main reason to check for multicollinearity is that in the case of high multicollinearity among the regressors, their estimates possess large standard errors which implies that the coefficients cannot be estimated with a high degree of precision or accuracy. Furthermore, in case of perfect multicollinearity, the regressor coefficients become indeterminate.

In this study we apply the Pearson Pairwise correlation test to confirm the correlation among the dependent and independent variables. We also use it to test for multicollinearity among the regressors used in our regression models. We follow the critical value of correlation (that is, 0.8) among the two regressors to detect the presence of multicollinearity, as suggested by Gujarati (2009). The test statistics of Pearson correlation, between the variables used in our regression models, are presented in Appendix Tables B.2.1, B.2.2 and B.2.3. The results show a significant correlation among the dependant and independent variables in each model. Moreover, the correlation coefficients between all the regressors, remain under the critical value of 0.8, which shows no sign of the multicollinearity problem among the selected variables.

4.3.3 Hausman Test for Fixed or Random Effects

We further examined whether individual effects are fixed or random. To choose between the fixed or random effect models, we applied Hausman test. The idea underlying the Hausman test is that both the fixed effects and random effects estimators (say θb_1 and θb_2 respectively) are consistent if there is no correlation between the error terms (μ_i) and the regressors$(\boldsymbol{X}_{it})$. The test compares the consistent fixed effects estimator with the random effects estimator that is assumed to be efficient. The null hypothesis of no systematic difference between the two estimators is given as.

$$\mathrm{H}_0: \theta b_{1it} - \theta b_{2it} = 0$$

$$\mathrm{H}_1: \theta b_{1it} \neq \theta b_{2it}$$

The test statistics of the Hausman test, between the pairs of coefficients of variables in our regression models, are presented in Appendix Tables B.3.1, B.3.2 and B.3.3. The results show that the null hypothesis of the difference in coefficients between fixed and random estimation is systematically rejected at a 1% significance level, providing support for the fixed effects model.

4.3.4 Breusch-Pagan/Cook Weisberg Test for Heteroscedasticity

Another critical assumption of CLRM is that the residuals (μ_i) must have a constant variance (σ^2) over time and among the groups; that is, that the disturbances are homoskedastic (Gujarati, 2009).

The mathametical notation of homoskedatsticity can be written as follows:

$$\boldsymbol{E(\mu_i^2) = \sigma^2;\ \text{for all } i,} \qquad \text{where } i = 1, 2, \ldots\ldots, N \qquad \textbf{(4.2)}$$

In the context of panel data analysis, the deviation from homoskedastic errors is likely to be error variances specific to the cross-sectional unit i – a condition termed as heteroskedasticy, which can be expressed as:

$$\boldsymbol{E(\mu_i^2) = \sigma_i^2,} \qquad \text{where } i = 1, 2, \ldots\ldots, N \qquad \textbf{(4.3)}$$

Following Greene (2003), we applied Breusch – Pagan modified Wald statistics for groupwise heteroskedasticity in the error terms of the fixed effect regression models.

$\mathrm{H}_0: \sigma_i^2 = \sigma^2$; for all i where $i = 1,2, \ldots\ldots, N$

$\mathrm{H}_1: \sigma_i^2 \neq \sigma^2$

The null hypothesis states that for all the banks the error variances remain constant (σ^2) over the time period. We tested for the presence of heteroskedasticy using *xttest3* syntax command in Stata (v. 14.0). The test results for all of the regression models are reported in Appendix Table B.4.1. The p-value of the χ^2 statistics show that the null hypothesis is stongly rejected for all the regression models and confirms the presence of heteroskedastic disturbances in these models. As Gujarati (2009) notes, the presence of heteroskedasticity in residuals violates CLRM assumptions as the ordinary least squares (OLS) estimation. Although it remains consistent and unbiased it is no longer efficient; that is, the parameters do not possess minimum variances and hence are not BLUE. The GMM estimation technique is preferred over OLS, generalized least squares (GLS) and two stage least squares (2SLS) if there exist unobserved heteroskedasticity in the error terms (Greene, 2003).

4.3.5 Woodridge Test for Autocorrelation in Panel Data

The problem of autocorrelation arises when the disturbance term of one particular observation correlates with the residual of another observation, which violates the CLRM (Gujarati, 2009). In mathematical form, the CLRM assumption of no autocorrelation can be written as:

$$\boldsymbol{cov}(\boldsymbol{u_i}, \boldsymbol{u_j}|\boldsymbol{x_i}, \boldsymbol{x_j}) = \boldsymbol{E}(\boldsymbol{u_i}, \boldsymbol{u_j}) = \boldsymbol{0} \qquad \boldsymbol{i \neq j} \tag{4.4}$$

Gujarati (2009) and (Baltagi, 2008) argue that as the influence of economic events is persistence over time, the assumption of no autocorrelation is very restrictive in panel nature data. In the case of the presence of serial correlation, the GMM approach works more efficiently than pooled OLS or FE (Wooldridge, 2001). In this study, we employed the Wooldridge test of no-autocorrelation. According to Drukker (2003) the Wooldridge test of autocorrelation can address the unbalanced panel data with or without gaps in the observations. Moreover, this test is more efficient as it relaxes several specification assumptions, including the unobserved individual fixed effects, the presence of heteroskedasticity and the need of non-stochastic regressors Drukker (2003).

The nul hypothesis of the Wooldridge test is that no serial correlation exists in the sample data. Therefore, if p-value of this test's result is lower than 0.05, then the null hypothesis is rejected in favor of alternative hypothesis of autocorrelation i.e., $E(u_i, u_j) \neq 0$, which means that the data has serial correlation, hence the use of GMM is preferred over pooled OLS or FE estimators. The test results for all of the regression models are presented in Appendix Table B.5.1. The p-value of less than 0.05 shows that the null hypothesis is rejected for all of the regression models and confirms the presence of autocorrelation in the error terms in these models.

4.4 Estimation Results – Determinants of Maturity Transformation Risk Model

Table 4.2 presents the two-step System GMM dynamic panel data estimation results of "Determinants of Maturity Transformation Risk" model (equation 3.6), using the net stable funding ratio (NSFR) as the dependent variable.

Table 4.2 Estimations based on Net Stable Funding Ratio ($NSFR_{it}$) as Dependent Variable using Two-step System GMM Model

	(A)	(B)	(C)	(D)
$NSFR_{it-1}$	0.5463*** (0.8212)	0.5822*** (0.0900)	0.5579*** (0.0870)	0.6024*** (0.0913)
$SIZE_{it}$	-7.5327** (3.4375)	-11.0663*** (3.8688)	-7.2829** (3.3641)	-10.3268*** (3.5970)
CAP_{it}	-0.5354*** (0.1068)	-0.4782*** (0.1324)	-0.4302*** (0.1134)	-0.3989*** (0.1465)
$ROAA_{it}$	2.5577*** (0.9620)	2.4820** (1.0304)	2.0569** (0.9654)	1.9785* (1.0849)
$LRLA\_TA_{it}$	1.3430*** (0.3715)	1.2969*** (0.3863)	1.3079*** (0.3851)	1.2446*** (0.3828)
RLA_TA_{it}	0.9133*** (0.2052)	0.8069*** (0.1945)	0.8573*** (0.2051)	0.7469*** (0.2008)
MP_{it}	2.3811 (1.4769)	3.3594** (1.6532)	2.3791 (1.4490)	3.2551** (1.5765)
$LLRTL_{it}$	0.0017 (0.4207)	0.2641 (0.3066)	0.1315 (0.4575)	0.2292 (0.3723)
NDD_{it}	-0.5003*** (0.1555)	-0.5517*** (0.2054)	-	-
STB_{it}	-	-	-0.5009*** (0.1775)	-0.5771** (0.2255)
GDP_i		-0.0379 (0.1983)		-0.0348 (0.1942)
INF_i		-1.0534** (0.4457)		-1.0826** (0.4135)
cons.	195.4170** (77.0498)	273.0737*** (86.8460)	187.8409** (76.1715)	254.3749*** (80.5638)

Equation (A) and (B) are the two specifications of our proposed model in equation (3.6), where equation (A) estimates the bank-specific variables only, while macroeconomic variables are included in equation (B). Equation (C) and (D) are also estimated with the similar specifications, using *short-term borrowing to customer deposit and total short-term borrowing* (STB) as an alternative measure of external funding. All explanatory variables are defined in Table 3.2.
Robust standard errors are in parenthesis. ***, ** and * indicates statistical significance at 1%, 5% and 10%, respectively.

Source: Authors' calculations using Stata (v 14.0) software.

We applied two specifications in equation (3.6). First, we ran the regression using only bank specific variables and for the second specification, we included macroeconomic variables in the model. Equation (A) in Table 4.2 shows the results with bank-specific variables only while equation (B) includes macroeconomic variables in the model as well. We also included an alternative measure of external funding (that is, STB instead of NDD) and re-ran our model

with the same specifications. The regression results, using bank specific factors only and with the inclusion of macroeconomic factors, are shown in equations (C) and (D), respectively. The estimation results obtained from both specifications, as well as those which utilize the alternative measures for external funding dependence, were mostly in line with our expectations.

A higher value of NSFR reflects lesser maturity transformation risk. Thus, the results in Table 4.2 are interpreted in reverse order; in other words, a positive sign of the coefficient shows a negative impact on the exposure to maturity transformation risk. The lagged dependent variable is significant at a 1% level, confirming the dynamic specification of the model, which implies that banks' current exposure to maturity transformation risk is moderately affected by their stable funding from previous years.

Among the explanatory variables, the coefficients of most bank-specific factors, including bank size, capitalization, profitability, less-risky liquid assets and non-deposit dependence, are consistent with our expectations and confirm our hypotheses. However, we found a stark contrast from our hypothesis in explaining the effect of risky liquid assets and market power on banks' maturity transformation risk. The positive and statistically significant relationship between SIZE and risk is consistent with Čihák and Hesse's (2010) findings that large Islamic banks create more liquidity. Large Islamic banks may find incentive to invest in more illiquid assets for higher gains at a decreased funding cost. However, while doing so, they also increase their maturity transformation risks. Our findings are also consistent with previous studies (Delechat et al., 2012; Rauch et al., 2009,Iannotta et al., 2007), where authors argue that the banks' liquidity risk increases along with increasing size.

Bank capitalization (CAP) also shows a highly significant and positive relationship with maturity transformation risk in Islamic banks. An increase of 1% in bank capital, results in an increase of 0.53% in maturity transformation risk in the sample banks. The results reveal that better capitalized banks are more involved in their liquidity creation function, which in turn exposes them to a higher degree of maturity transformation risk. This view favours the "risk absorption" hypothesis or the idea that higher capital improves the bank's ability to create more liquidity (Repullo, 2004).

Among other explanatory variables, bank performance, liquid assets (both less-risky liquid assets and risky liquid assets), and market power have shown a statistically significant impact on maturity transformation risk, but in the opposite direction. The positive and statistically significant coefficient of bank performance (ROAA) reflects that increased profitability helps Islamic banks to increase their liquidity position, therefore reducing their exposure to maturity transformation risk. The results imply that the Islamic banks' profits are procyclical in nature. In short, increased profits will allow banks to offer better liquidity. Our findings are consistent with Bourke (1989), Demirguc et al. (2003), and Kosmidou et al.'s (2005) findings. These authors all record a positive relationship between bank profitability and liquidity.

As hypothesized, the coefficient of less-risky liquid assets to total assets ratio (LRLA_TA) shows a negative association with maturity transformation risk, at a significance level of 1%. The results reveal that the sample Islamic banks can mitigate their transformation risk by holding much liquid assets, such as cash and balances with central banks, and/or short-term marketable instruments (like Islamic treasury bills and other short-term government securities). Shen et al. (2009) found similar results, and suggested that banks enhance their liquidity shock absorption capacity while increasing the proportion of highly liquid assets in their total assets, thereby minimizing their maturity transformation risk. Nevertheless, holding a high share of liquid assets ensures a bank's ability to meet its financial obligations (to its customers).

In contrast to our expectation of a positive relationship, the results reveal a statistically significant and negative impact of the ratio of risky liquid assets to total assets (RLATA) on maturity transformation risk. This suggests that Islamic banks that hold part of their assets in the portfolios, such as trading securities and other medium and long-term investments, are able to meet their liquidity requirements when the need arises, even though these come at a relatively higher cost than securing funds through less-risky liquid assets. Since, both risky liquid assets and less-risky liquid assets constitute banks' overall liquid assets, the higher proportion in total assets prevents a bank from failing in its liquidity commitments, such as customers making large deposit withdrawals and any such unexpected future costs (Vodová, 2013; Shen et al., 2009).

The coefficient of market power (MP) remains statistically insignificant, when using only bank-specific variables to estimate our model (equation A). However, the variable shows a significant impact in mitigating the maturity transformation risk in our sample banks, after controlling for macroeconomic variables in the model (equation B). The positive and statistically significant coefficient of market power (MP) on the dependent variable implies that the capacity of Islamic banks in meeting their liquidity obligations increases with an increase in their market power, thus reducing their maturity transformation risk. Nguyen et al. (2013) provides support for this argument. They noted that banks with high market power tend to increase their liquidity through ease of access to funding sources. However, this may provide banks with incentive to accelerate their liquidity creation function which leads to increased exposure of maturity transformation risk. The results show that Islamic banks with greater market power enjoy more ease of access to low cost market funding sources, thus enabling them to meet their liquidity requirements, as and when required.

Additionally, our study also revealed a statistically significant and positive relationship between market funding and maturity transformation risk in our sample banks. We utilized two measures of external funding dependence. In equations A and B, we estimated our model specifications using total short and long-term borrowing, scaled on total liabilities (NDD), as a proxy, for external funding dependence. To further test the consistency of our results, we utilized the ratio of short-term borrowing to customer deposit and total short-term borrowing (STB), and estimated equations C and D, for both specifications. As expected, in all cases, an excessive reliance on funding sources other than deposits expose Islamic banks to a higher degree of maturity transformation risk. The results are even robust when we used an alternative measure of external funding structure. This finding is consistent with Basel's (2009) argument that short-term deposits are considered to be a more stable funding source than short-term market debt. Thus, it can be said that the maturity transformation risk in our sample Islamic banks will increase with more dependence on market funding sources. Our results reiterate those of Angora and Roulet (2011), Shen et al. (2009), Saunders and Cornett (2007).

Among the macroeconomic variables, the consumer price index, as a proxy for inflation (INF), shows a significant and positive impact on maturity transformation risk at a 5% level. This implies that an increase in the general price level of goods and services is directly related to

higher production costs, resulting in augmented borrowing demands from individuals and business enterprises. This increases banks' lending opportunities, which effectively increases their exposure to maturity transformation risk. Our findings are consistent with several previous studies (Shen et al., 2009; Pasiouras & Kosmidou, 2007; Athanasoglou et al., 2006) and shows that a percentage point increase in inflation rate will increase the maturity transformation risk among our sample banks by 1.05%.

Our estimation results show no significant effect of loan loss reserves to total loan ratio on the maturity transformation risk in Islamic banking. We also find no significant evidence of the impact of gross domestic product (GDP) as a measure of economic activity, on maturity transformation risk in Islamic banks during the sample period.

4.4.1 Robustness Check

In order to confirm the robustness of our estimation results, we re-ran equation 3.6 with same specifications, utilizing the Financing Gap Ratio (FGR) as an alternative measure for the maturity transformation risk. The results of equations A1 and B1 in Table 4.3 reveals the estimates of bank-specific only and inclusive of macroeconomic variables, respectively, where NDD is used as a measure of external funding dependence. Further robust results were obtained from equations C1 and D1 applying both specifications, using STB as an alternative measure of external funding dependence. The estimates obtained in all four equations are largely consistent with previously obtained results in our initial analyses, in terms of the relationship and statistical significance. These tests thus verify the robustness of the results. The estimation results for FGR, as the dependent variable of maturity transformation risk, with two-step system GMM, are reported in Table 4.3.

Table 4.3 Estimations based on Financing Gap Ratio (FGR_{it}) as Dependent Variable using Two-step System GMM

	(A1)	(B1)	(C1)	(D1)
FGR_{it-1}	0.4313***	0.4948***	0.5696***	0.5928***
	(0.1415)	(0.1418)	(0.1029)	(0.0937)
$SIZE_{it}$	4.5562**	4.6655**	3.9829***	4.1120**
	(1.9780)	(1.8136)	(1.3700)	(1.3001)
CAP_{it}	0.5515***	0.4812***	0.3341**	0.3093**
	(0.1812)	(0.1731)	(0.1527)	(0.1447)
$ROAA_{it}$	-0.2898	-0.2324	-0.1406	-0.0720
	(0.4722)	(0.4277)	(0.3210)	(0.3306)
$LRLA\_TA_{it}$	-0.5158***	-0.4930***	-0.4190***	-0.4510***
	(0.1631)	(0.1549)	(0.1309)	(0.1165)
RLA_TA_{it}	0.3498***	0.3302***	0.2809***	0.2747***
	(0.1087)	(0.1000)	(0.0793)	(0.0709)
MP_{it}	-0.5564***	-0.5620***	-0.4238**	-0.3941**
	(0.2037)	(0.1997)	(0.1918)	(0.1816)
$LLRTL_{it}$	0.3426**	0.3086**	0.2826**	0.2870**
	(0.1425)	(0.1456)	(0.1409)	(0.1268)
NDD_{it}	0.6213***	0.5734***	-	-
	(0.1548)	(0.1397)		
STB_{it}	-	-	0.4364***	0.4673**
			(0.0978)	(0.0969)
GDP_i		-0.0898		-0.0682
		(0.0958)		(0.1084)
INF_i		0.2843*		0.2078
		(0.1609)		(0.2036)
cons.	-112.4755**	-114.124***	-94.8963**	-98.4065***
	(45.4679)	(41.8243)	(32.6077)	(30.6605)

Note: FGR is used as an alternative measure of maturity transformation risk. Equation (A) and (B) are the two specifications of our proposed model in equation (3.6), where equation (A) estimates the bank-specific variables only, while macroeconomic variables are included in equation (B). Equation (C) and (D) are also estimated with the similar specifications, using *short-term borrowing to customer deposit and total short-term borrowing* (STB) as an alternative measure of external funding. All explanatory variables are defined in Table 3.2.
Robust standard errors are in parenthesis. ***, **, * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Author's calculations using Stata (v 14.0) software.

Apart from bank performance (ROAA) and credit risk (LLRTL), all other coefficients are highly consistent with the initial results, where the new liquidity regulation NSFR, serves as the measure for maturity transformation risk. The former shows an insignificant relationship with FGR (as the alternative measure of maturity transformation risk), while the later reveals a positive and statistically significant relationship. One possible explanation of this variation

may be because of the sensitivity of the dependent variable with the explanatory variables. FGR is primarily the difference between total loans and customer deposits, which is more sensitive to the loan loss reserves held by a bank in a given time period. However, since bank profitability is procyclical in nature, as an indicator of stable funding structure, NSFR increases alongside increasing ROAA.

4.4.1.1 Alternative Estimation Technique

We utilized quantile regression for panel data to estimate the relationship between the covariates and the dependent variable at different points in the distribution of $'y'$ conditional on median (Powell, 2016), thus proving further evidence of the robustness of our previous results. This estimation technique is utilized to determine the behaviour of the explanatory variables in our initial model (equation 3.6) among various groups, formed through the conditional distribution of the dependent variable (Baum, 2013). We formed various quartiles ranging from q10 to q90, to determine the effect of our explanatory variables in each group.

Table 4.4 shows the result of each quartile. The overall results are consistent with the initial estimates based on the two-step System GMM, both in terms of direction and significance. More specifically, among the bank-specific variables, SIZE is positive and statistically significant with maturity transformation risk in q10 and q20. However, it loses its significance in q30 and q40, but becomes significant from q50 onwards. This result implies that individual bank size is not statistically significant for the group of banks, which maintain NSFR value between q30 and q40. Moreover, bank capitalization (CAP) loses its significance in q50 and q70. Similarly, ROAA shows insignificance in q50 only.

The bank-specific variables, LRLA_TA, RLA_TA and NDD, and the macroeconomic variable, INF, show consistent significance in each of the quartiles. These factors contribute most in determining the maturity transformation risk in our sample banks. Further, MP shows a significant relationship with the dependent variable from q60 onwards, revealing that MP may not be a contributing factor in determining maturity transformation risk in our sample banks, within the lower quartiles range. Similarly, credit risk (LLRTL) shows a significant effect in determining the maturity transformation risk in lower and higher quartiles. However, it becomes insignificant in mid quartile range (from q50 to q70). Surprisingly, GDP also shows a highly significant and negative relationship with maturity transformation risk of our sample

banks in q60 and q80 only, whereas we were unable to determine any relationship between GDP and risk in our initial estimates using the system GMM technique.

Table 4.4. Quantile Regression Estimations (Net Stable Funding Ratio (NSFR) as Dependent Variable)

	q10	q20	q30	q40	q50	q60	q70	q80	q90
$NSFR_{it-1}$	0.2141***	0.3129***	0.3568**	0.6456***	0.6611***	0.6145***	0.7770***	0.6561***	0.8669***
	(0.0207)	(0.0469)	(0.1410)	(0.0612)	(0.1004)	(0.0261)	(0.0143)	(0.0730)	(0.0240)
$SIZE_{it}$	-0.0097***	-0.0153***	-0.0056	0.0021	-0.0250***	-0.0849***	-0.0521***	-0.0497***	-0.0588***
	(0.0033)	(0.0023)	(0.0039)	(0.0041)	(0.0035)	(0.0054)	(0.0087)	(0.0108)	(0.0089)
CAP_{it}	-0.0071***	-0.0041***	-0.0055***	-0.0024***	0.0032	-0.0020***	-0.0003	-0.0029***	-0.0059***
	(0.0010)	(0.0009)	(0.0014)	(0.0003)	(0.0031)	(0.0003)	(0.0002)	(0.0005)	(0.0008)
$ROAA_{it}$	0.0060**	0.0135***	0.0121***	0.0095***	-0.0079	0.0163***	0.0077***	-0.0130*	0.0162***
	(0.0025)	(0.0047)	(0.0022)	(0.0014)	(0.0090)	(0.0016)	(0.0029)	(0.0078)	(0.0027)
$LRLA\_TA_{it}$	0.0133***	0.0089***	0.0137***	0.0094***	0.0112***	0.0134***	0.0114***	0.0193***	0.0111***
	(0.0011)	(0.0007)	(0.0035)	(0.0009)	(0.0019)	(0.0006)	(0.0002)	(0.0043)	(0.0006)
RLA_TA_{it}	0.0101***	0.0088***	0.0100***	0.0068***	0.0064***	0.0093***	0.0063***	0.0084***	0.0070***
	(0.0005)	(0.0007)	(0.0021)	(0.0007)	(0.0009)	(0.0006)	(0.0003)	(0.0021)	(0.0008)
MP_{it}	0.0004	0.0005	-0.0018	0.0002	-0.0031	0.0146***	0.0039***	0.0171***	0.0045***
	(0.0012)	(0.0005)	(0.0020)	(0.0007)	(0.0056)	(0.0011)	(0.0008)	(0.0044)	(0.0015)
NDD_{it}	-0.0043***	-0.0035***	-0.0034***	-0.0033***	-0.0049***	-0.0041***	-0.0014***	-0.0037***	-0.0008**
	(0.0001)	(0.0002)	(0.0003)	(0.0001)	(0.0007)	(0.0002)	(0.0002)	(0.0009)	(0.0003)
$LLRTL_{it}$	0.0016**	0.0043***	0.0029***	0.0007**	0.0020	0.0000	-0.0003	-0.0039*	0.0077***
	(0.0007)	(0.0005)	(0.0007)	(0.0003)	(0.0022)	(0.0003)	(0.0013)	(0.0022)	(0.0021)
GDP_{jt}	0.0025	0.0008	-0.0004	0.0000	-0.0006	0.0031***	0.0018	0.0072***	0.0036
	(0.0016)	(0.0010)	(0.0009)	(0.0007)	(0.0012)	(0.0009)	(0.0012)	(0.0020)	(0.0038)
INF_{jt}	-0.0114***	-0.0045***	-0.0078***	-0.0042***	-0.0023*	-0.0150***	-0.0057***	-0.0049*	-0.0137***
	(0.0009)	(0.0008)	(0.0022)	(0.0006)	(0.0012)	(0.0015)	(0.0010)	(0.0027)	(0.0028)

Note: Bootstrap standard errors are in parenthesis. ***, ** and * indicates statistical significance at 1%, 5% and 10% levels, respectively.
Source: Author's calculations using Stata (v 14.0) software.

4.4.2 Validity of Two-step System GMM Estimations

The validity of the two-step System GMM depends on the strength of instrumental variables. Among others, a fundamental requirement is exogenous instruments, which ensures the consistency of the estimations. The exogeneity of instruments can be assessed by the Sargan or Hansen *J* test for over-identified restrictions, under the null hypothesis that the instruments, as a group, are exogenous. The test statistics follow the Chi-squared (χ^2) distribution, with degrees of freedom equalling the difference between the number of moment conditions and the number of parameters. While the Hansen *J* test is more robust than the Sargan test to heteroscedasticity and autocorrelation, it is significantly weakened by instrument proliferation. However, as can be seen from the results reported in Tables 4.5 and 4.6, the number of instruments is smaller than the number of groups, as suggested by Roodman (2009b). Therefore, the Hansen *J* test is reasonably employed in our study.

While the Hansen *J* test examines the endogeneity of instruments as a group, the validity of subsets of instruments could also be examined by the Difference-in-Hansen test. Under the null hypothesis of the exogeneity of instrument subset, the test statistic follows the Chi-squared (χ^2) distribution, with degrees of freedom equalling the number of suspect instruments. In this study, the instrumental variables are divided into two smaller subsets, including IV-style and GMM-style instruments. The test results in Tables 4.5 and 4.6 show that the null hypothesis cannot be rejected at the 10% significance level, which confirms that the instruments subsets used in both IV style and GMM style are exogenous.

Another condition of valid instruments is no autocorrelation in the first-differenced idiosyncratic disturbances $\Delta\varepsilon_{it} = \varepsilon_{it} - \varepsilon_{it-1}$. The negative first-order autocorrelation AR(1) is expected, since $\Delta\varepsilon_{it}$ relates to $\Delta\varepsilon_{it-1}$ via the shared term ε_{it-1}; however the evidence is uninformative (Roodman, 2009b). Therefore, the test of second-order autocorrelation AR(2) should be addressed. This study tests for autocorrelation in disturbances proposed by Arellano & Bond (1991), with the null hypothesis of no autocorrelation, which is widely accepted as the standard test for autocorrelation in GMM. If the nth -order autocorrelation is not present, lags of n or further could be utilized as instruments. Since this study uses lags of 2 and earlier, the AR(2) tests must be insignificant to ensure the validity of the models.

Tables 4.5 and 4.6 present the summary of the post estimation tests to confirm the validity of the two-step System GMM estimators. We utilized NSFR and FGR as dependent variables in the determinants of maturity transformation risk models, respectively. All F-statistics of the estimations are highly significant at the 1% significance level. Thus, the joint null hypothesis that all estimated coefficients are jointly equal to zero is rejected. In other words, at least one of the parameters in each model is non-zero, indicating the overall significance of the models (Hill, Griffiths, & Lim, 2008).

Table 4.5 Post-estimation Specification Tests in Determinants of Maturity Transformation Risk Model (NSFR as the Dependent Variable)

	(A)	**(B)**	**(C)**	**(D)**
F-Statistics	53.90 p = 0.000	49.31 p = 0.000	34.07 p = 0.000	29.57 p = 0.000
AR(1) test stat	-2.56 p > z = 0.011	-2.55 p > z = 0.011	-2.60 p > z = 0.009	-2.61 p > z = 0.009
AR(2) test stat	-0.58 p > z = 0.561	-0.31 p > z = 0.756	-0.45 p > z = 0.655	-0.24 p > z = 0.812
Hansen *J*-stat	χ^2 (23) = 25.16 p > z = 0.342	χ^2 (23) = 21.65 p > z = 0.541	χ^2 (23) = 24.84 p > z = 0.359	χ^2 (23) = 21.44 p > z = 0.554
Difference-in-Hansen tests				
- *GMM instruments for levels*	χ^2 (7) = 9.24 p > z = 0.236	χ^2 (7) = 6.26 p > z = 0.541	χ^2 (7) = 9.15 p > z = 0.242	χ^2 (7) = 7.33 p > z = 0.396
- *IV*	χ^2 (7) = 8.89 p > z = 0.261	χ^2 (9) = 8.06 p > z = 0.541	χ^2 (7) = 8.15 p > z = 0.319	χ^2 (9) = 7.38 p > z = 0.597
No. of Instruments	33	35	33	35
No. of Banks	55	55	55	55
Observations	412	412	412	412

Source: Author's calculations using Stata (v 14.0) software

Table 4.6 Post-estimation Specification Tests in Determinants of Maturity Transformation Risk Model (FGR as the Dependent Variable)

	(A1)	(B1)	(C1)	(D1)
F-Statistics	63.12 p = 0.000	65.03 p = 0.000	75.95 p = 0.000	49.56 p = 0.000
AR(1) test stat	-2.32 p > z = 0.020	-2.62 p > z = 0.009	-3.10 p > z = 0.002	-3.18 p > z = 0.001
AR(2) test stat	0.21 p > z = 0.836	0.42 p > z = 0.675	0.29 p > z = 0.769	0.32 p > z = 0.752
Hansen *J*-stat	χ^2 (22) = 22.79 p > z = 0.414	χ^2 (22) = 20.71 p > z = 0.539	χ^2 (37) = 31.14 p > z = 0.739	χ^2 (40) = 36.45 p > z = 0.631
Difference-in-Hansen tests				
- *GMM instruments for levels*	χ^2 (8) = 10.65 p > z = 0.222	χ^2 (8) = 7.90 p > z = 0.444	χ^2 (8) = 11.07 p > z = 0.198	χ^2 (8) = 12.43 p > z = 0.133
- *IV*	χ^2 (8) = 4.88 p > z = 0.770	χ^2 (10) = 7.25 p > z = 0.702	χ^2 (8) = 5.52 p > z = 0.701	χ^2 (10) = 8.04 p > z = 0.625
No. of Instruments	32	34	47	52
No. of Banks	55	55	55	55
Observations	412	412	412	412

Source: Author's calculations using Stata (v 14.0) software

The validity of two-step System GMM estimation is assessed through the number of instruments employed; AR(2), Hansen *J* and Difference-in-Hansen tests. The GMM estimation is considered valid if the number of instruments used is smaller than the number of groups, and the results of all other tests are insignificant (that is, p-values are larger than 0.10). The AR(1) tests' z-statistics are negative and statistically significant in all of the specifications of our model, defined in equation 3.6. This indicates the presence of negative first-order autocorrelation among idiosyncratic disturbances in difference. However, the z-statistics of the AR(2) tests in all specifications are insignificant with p-values 0.561, 0.756, 0.655 and 0.812 in Table 4.5 and p-values 0.836, 0.675, 0.769 and 0.752 in Table 4.6, respectively. Therefore, it is not possible to reject the null hypothesis of no second-order serial correlation in idiosyncratic errors in first difference, indicating the nonexistence of the first-order autocorrelation in their levels. Thus, lags from period 2 or earlier in levels could be employed as instruments in the differenced equation Roodman (2009b). In other words, the results support the choice of lags from period 2 and earlier as valid instruments in this study.

The Hansen tests of over-identification in Table 4.5 reveal the *J*-statistics of 25.16 (p-value = 0.342), 21.65 (p-value = 0.541), 24.84 (p-value = 0.359) and 21.44 (p-value = 0.554) in equations (A), (B), (C) and (D), respectively. Similarly, Table 4.6 reports the Hansen *J* test statistics of 22.79 (p-value = 0.414), 20.71 (p-value = 0.539), 31.14 (p-value = 0.739) and 36.45 (p-value = 0.631) in equations (A1), (B1), (C1) and (D1), respectively. The p-values greater than 10% indicate that the null hypothesis of the enxogeneity of all instruments, as a group, can be accepted. Furthermore, to test the exogeneity of instrument subsets, i.e. GMM-style instruments for levels and IV-style instruments, the Difference-in-Hansen tests are conducted. All p-values of the Difference-in-Hansen test statistics for all specifications in both Tables 4.5 and 4.6 are insignificant (with $p > 0.10$). Therefore there is no evidence to reject the null hypothesis of exogeneity of instruments subsets. Hence, the results of both the Hansen test and the Difference-in-Hansen test support the exogeneity of the instrumental variables used in all the specifications. Such exogeneity is a crucial characteristic of good instruments. In addition, the number of instruments is kept smaller than the number of groups, as recommended by Roodman (2009b). Therefore, the consequences of too many instruments, is avoided. Conclusively, all post-estimation specification tests strongly support the validity of the two-step System GMM estimators.

4.5 Estimation Results – Maturity Transformation Risk and Islamic Banks' Profitability Model

This section provides empirical evidence of the effect of maturity transformation risk on Islamic bank profitability. Table 4.7 presents the two-step System GMM dynamic panel data estimation results of "Maturity Transformation Risk and Islamic Banks' Profitability" model, using return on average assets (ROAA) as the dependent variable.

We applied three specifications to our regression model (equation 3.7). First, we ran the regression using only bank specific variables. For the second and third specifications, we included industry-specific and macroeconomic variables in our model, respectively. Equation A in Table 4.7 shows the effect of maturity transformation risk and other bank-specific variables on the profitability of Islamic banks. We also controlled for the industry-specific effects on Islamic bank profitability in equation B. The model is re-estimated after controlling

for the macroeconomic factors, in addition to the bank-specific and industry-specific explanatory variables. The results are presented in equation (C).

Table 4.7 Two-step System GMM Estimations (Return on Average Assets ($ROAA_{it}$) as the Dependent Variable)

	(A)	(B)	(C)
$ROAA_{it-1}$	0.5484 ***	0.8088 ***	0.7823 ***
	(0.1764)	(0.1329)	(0.1045)
$NSFR_{it}$	0.3972 **	0.5538 **	0.5048 **
	(0.1965)	(0.2751)	(0.2274)
$SIZE_{it}$	0.0465	-0.209 **	-0.2548 **
	(0.0599)	(0.0923)	(0.0996)
CAP_{it}	0.0626 *	0.1087 ***	0.1075 ***
	(0.0359)	(0.031)	(0.0223)
$NONII\_TA_{it}$	0.0579	0.1132	0.1322
	(0.1161)	(0.106)	(0.0821)
EFF_{it}	-0.0174 ***	-0.0091	-0.0097 *
	(0.0065)	(0.007)	(0.0051)
$LLRTL_{it}$	-0.0219 **	-0.0485 ***	-0.0411 ***
	(0.0086)	(0.0132)	(0.012)
3_CONC_{it}		0.0126 ***	0.0110 **
		(0.0044)	(0.0043)
GDP_{jt}			0.0462 ***
			(0.012)
INF_{jt}			-0.0471 *
			(0.0251)
cons.	1.9658	2.2834 *	2.8684 **
	(1.0736)	(1.2633)	(1.0835)

Equations A, B and C are the three specifications of our proposed model in equation (3.7), where equation (A) estimates the bank-specific variables only, while industry specific and macroeconomic variables are included in equation (B) and (C), respectively. All explanatory variables are defined in Table 3.3.
Robust standard errors are in parenthesis. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Author's calculations using Stata (v 14.0) software.

The lagged profitability variable ($ROAA_{it-1}$) remains highly significant in all the three specifications, which confirms the dynamic character of our model. The coefficient ∂_1 takes the values of 0.55, 0.81 and 0.78 in equations (A), (B) and (C), respectively, which indicate a moderate persistence of profitability over time in the sample Islamic banks. Since the value of ∂_1 is near 1, this implies that the sample Islamic banks operate in a relatively less competitive market structure. The significant coefficients in all specifications also confirm

that one should consider temporal effects of profit persistence when explaining banks' profitability. The recent banking literature also found evidence of profit persistence in Islamic banks (Trad et al., 2017; Zarrouk et al., 2016; Mirzaei, 2011), as well as in conventional banks (Djalilov & Piesse, 2016 ; Dietrich & Wanzenried, 2014; Goddard et al., 2011; Athanasoglou et al., 2008).

According to Table 4.7, for all the regression specifications, the net stable funding ratio (NSFR) coefficient is statistically significant at a 5% level, with values of 0.39, 0.55 and 0.50 in equations (A), (B) and (C), respectively. The positive sign of the coefficients in all of the models are also in accordance with our expectation, which confirms our hypothesis. Moreover, the results show that the effect of net stable funding ratio on profitability increases after controlling for industry-specific and macroeconomic factors. Since maturity transformation risk decreases with the increase in net stable funding ratio, the regression results reveal an inverse relationship between exposure to maturity transformation risk and profitability in Islamic banks, especially during the study period. For this reason, we find evidence that the inclusion of this new IFSB liquidity regulation can significantly increase the profitability of Islamic banks. Our results are consistent with the previous studies (for example, Olagunju et al., 2012; Goddard et al., 2011; Kosmidou 2008). All of these authors found that banks with high liquidity levels had better profitability. One possible reason for this could be that banks holding more liquid assets are less reliant on expensive market funding, which reduces their costs of borrowing and consequently, they are more profitable. However, our results are contradictory to Curak et al. (2012), Naceur and Kandil (2009), and Li (2007) among others, who contend that bank profitability can be significantly reduced by holding more liquid assets because of low yield.

Among the other explanatory variables, the coefficients of the bank-specific factors are mostly in line with the expected signs, providing empirical evidence of our stated hypotheses. Capitalization (CAP) shows a positive and significant impact on Islamic bank profitability in all specifications, which confirms our hypothesis. The coefficient of capitalization is around 0.062 – 0.108, implying a 1% increase in equity ratio increases the return on average assets by 0.06 – 0.11%. The positive impact of capitalization on bank profitability can be influenced by a number of reasons. Due to profit and loss sharing (PLS) principles, Islamic banks, with high bank capital, are more prudent in their lending, which reduces their credit risk and

consequently leads to increased profitability. However, banks with a sound capital position can more effectively pursue business opportunities and gain higher returns. Our results are consistent with Alharbi (2017), Trad et al. (2017), and Zarrouk et al.'s (2016) findings. These authors have all argued that higher equity proportion reduces overall risks and funding costs, which ultimately leads to increased profitability in Islamic banks. The idea that well-capitalized bank are less risky, have lower borrowing costs and are consequently more profitable, is also supported by, and Dietrich and Wanzenried (2014), Lee and Hsieh (2013), and Athanasoglou et al. (2008), in the case of the conventional banking system.

We also find a significant association between management efficiency measured by cost to income ratio (CIR) and Islamic banks' profitability in regression models (A) and (C) in Table 4.7. However, the coefficient of CIR becomes insignificant when we control for the industry specific variable in equation (B). Besides the three specifications, the direction of the relationship remains negative, which implies that the profitability of Islamic banks deteriorates with an increase in cost to income ratio. This result confirms our hypothesis that CIR is inversely related to bank profitability. This negative impact reflects management's inefficiency in controlling overhead costs because of the limited experience of Islamic banks and a lack of qualified staff. Alharbi (2017), Zarrouk et al. (2016), and Almazari (2014) all identified the negative impact of management inefficiency in terms of increased cost to income ratio on Islamic banks' profitability.

The coefficient of loan loss reserves to total assets (LLRTL) also shows an inverse significant relationship with the dependent variable ROAA (in all models). This implies that a higher credit risk adversely affects Islamic bank performance, during the study period. The results show coefficient estimates of -0.02, -0.05 and -0.04 in panel (A), (B) and (C) respectively, suggesting that a 1% increase in loan loss reserves ratio will deteriorate the return on average assets by 0.02 – 0.05%. This result confirms our expectation that an increase in the loan delinquency requires a bank to allocate a significant portion of its earnings to cover expected credit losses and consequently profitability will decrease. Though lending is the prime source of revenue generation for banks, it is also the major cause of credit risk, particularly when they invest in poor quality assets. In this case, monitoring expenses will rise and will adversely affect bank's profits. Our results also find support from the empirical work of Alharbi (2017), Almazari

(2014), and Wasiuzzaman and Tarmizi (2010). These authors reveal that high profitability of Islamic banks tend to be associated with better asset quality.

In contrast to our expected positive size – profitability relationship, bank size (SIZE) shows an inverse and statistically significant relationship with the profitability (ROAA) of Islamic banks during the study period. This is true after controlling for industry-specific and macroeconomic factors in equations (B) and (C), respectively. The results reveal that larger Islamic banks are less profitable than smaller banks, signifying economies of scale and scope for small Islamic banks and diseconomies of scale for larger institutions. This negative association is due to the increase in diversified activities, as larger banks tend to diversify more, which is linked with volatile returns. The other reason could be management inefficiency or because of the bureaucratic management style in larger Islamic banks. Our results also suggest that growing banks may face diminishing marginal returns so average profits would decline with size. Almazari (2014) and Akhtar, Ali, and Sadaqat (2011) also found similar results while analysing the factors influencing the profitability of Islamic banks in Pakistan. Similar results are reported for conventional banks by Sufian and Habibullah (2009), Pasiouras and Kosmidou (2007) and Kosmidou et al. (2005), where the authors find an inverse relationship between size and bank profitability.

Our result did not show any significant effect of income diversification on Islamic banks' profitability. Besides, the coefficient of non-interest income scaled to total assets (NONII_TA) remains positive in all three specifications. This shows that, although insignificant, income diversification fosters banks profitability. Since the Islamic banking industry is relatively new and the majority of the banks are the infancy stage, it is expected that Islamic banks rely more on traditional lending activities as their prime source of revenue generation. They are less involved in fee and commission income, income from sale of investment securities and other non-financing income. Therefore, the income diversification does not significantly improve the profitability of Islamic banks.

Moving on to industry-specific factors, we measured levels of bank competition by three largest banks concentration (3_Conc) ratio. As expected, the results show that the coefficient of 3_Conc is positive and significantly associated with the profitability of Islamic banks, at a significance level of 1% and 5%. These results are included in our regression model in panels

(B) and (C), respectively. Our results find empirical evidence to support the structure conduct performance (SCP) theory, that the profitability of Islamic banks is enhanced in a less competitive market structure, especially during the study period. Karim, Sami, and Hichem (2010), Ben Khediri and Ben-Khedhiri (2009), and Hassan and Bashir (2003) also found similar results and concluded that Islamic banks earn more profits in concentrated markets. Significantly Haron (1996) found that Islamic banks which operate in less competitive markets are more profitable, but at the cost of depositors' welfare.

Among the macroeconomic variables, the empirical results reveal that both economic growth and inflation are significant in explaining Islamic banks' profitability. The coefficient of Gross Domestic Product (GDP) growth rate shows a positive and highly significant impact on bank profits at a 1% level. This implies that economic growth could help banks to construct better operations strategies, and hence increase their profits. Generally, economic upswings encourage banks to increase their lending activities, charge higher margins and improve their asset quality, thus become more profitable. Our results are consistent with Zarrouk et al. (2016), Muda, Shaharuddin, and Embaya (2013), Wasiuzzaman and Tarmizi (2010), and Bashir's (2003), work. These authors all identify a positive correlation between the GDP growth and the profitability of Islamic banks.

The coefficient of inflation, measured in terms of CPI, shows a significant negative relationship with Islamic banks' profitability. The results reveal that Islamic banks face much difficulty in adjusting their profit rates, with respect to changes in the real economic activities. This negative relationship can be explained by the fact that inflation is not well anticipated by bank managers and Islamic banks are slow to adjust their interest rates, which ultimately results in increasing costs (relative to their revenue). Our results are similar to Zarrouk et al.'s (2016) findings. In case of MENA region, they argued that rapid inflation impeded the profitability of Islamic banks. However, Wasiuzzaman and Tarmizi (2010) and Asutay and Izhar (2007) reported contrary results when explaining the impact of inflation on Islamic bank's profitability in Indonesia and Malaysia, respectively. They argue that inflation is well anticipated in both markets and that Islamic banks achieve high profitability with increased inflation.

4.5.1 Robustness Check

We ran our regression equation (3.7) using the analogous dataset, with return on average equity ROAE as an alternative measure of Islamic banks' profitability, to ascertain whether our main findings were consistent. The similar three specifications were applied and the estimation results for ROAE, as a profitability measure, using the 2-step system GMM dynamic panel data approach reported in Table 4.8. Regression equation (A1) presents the results of the relationship of maturity transformation risk and other bank-specific factors, in explaining Islamic bank's profitability. Additionally, industry-specific and macroeconomic variables were also included along with the bank-specific explanatory variables in our regression model. The results are reported in equations (B1) and (C1), respectively. The estimates obtained in all three regressions models are largely consistent with previous results in our initial analyses, thus verifying the robustness of our main findings.

The highly significant positive coefficient of the lagged dependent variable confirms the dynamic nature of our model and also validates our argument to consider profit persistence while explaining Islamic banks' profitability. Moreover, the coefficient of NSFR remain significant and positive in all of the regression models, which also validates our empirical finding of an inverse relationship between maturity transformation risk and the profitability of Islamic banks. Among the other bank specific explanatory variables, bank capital (CAP), non-interest income (NONII), management efficiency (CIR) and credit risk (LLRTL) are significant factors in explaining Islamic bank's profitability, with ROAE as the dependent variable. We obtained similar results to our initial analysis, in terms of the relationship between bank capital and profitability, as the coefficient of CAP reveals a positive significant relationship with ROAE in all three specifications. We further found that NONII is a significant determinant of Islamic banks' profitability when we used ROAE as a profitability measure. Moreover, both CIR and LLRTL show similar negative and statistically significant relationships in all specifications with Islamic bank's profitability in terms of ROAE. Although the direction of the relationship between bank size and profitability is similar to our main findings, the SIZE variable loses its significance in explaining Islamic banks' profitability, in terms of ROAE. Similar to our initial estimates, the coefficient of concentration ratio (3_Cons) shows a positive and significant relationship with the dependent variable. This positive effect of concentration validates our argument on SCP theory; that Islamic banks charge monopolistic

rents in less competitive markets, and thus achieve higher profits. GDP growth rate and CPI (as macroeconomic determinants of profitability) are insignificant when Islamic banks' profitability is measured by ROAE.

Table 4.8 Two-step System GMM Estimations (Return on Average Equity ($ROAE_{it}$) as the Dependent Variable)

	(A1)	(B1)	(C1)
$ROAE_{it-1}$	0.4167 ***	0.4066 ***	0.436 ***
	(0.1258)	(0.1231)	(0.0918)
$NSFR_{it}$	10.094 *	10.1731 *	7.3738 *
	(5.5046)	(5.7409)	(3.9906)
$SIZE_{it}$	0.4138	-0.2794	-0.6004
	(0.9359)	(0.8276)	(1.0304)
CAP_{it}	0.6543 ***	0.8429 ***	0.6497 ***
	(0.2289)	(0.3112)	(0.2366)
$NONII\_TA_{it}$	1.9965 *	2.3464 **	1.8226 **
	(1.0311)	(1.1722)	(0.84)
EFF_{it}	-0.1296 ***	-0.1409 ***	-0.1518 ***
	(0.0464)	(0.0473)	(0.0436)
$LLRTL_{it}$	-1.975 **	-1.915 **	-1.5063 ***
	(0.7725)	(0.7358)	(0.536)
3_CONS_{it}		0.1271 *	0.1027 **
		(0.0682)	(0.0405)
GDP_i			0.1407
			(0.1465)
INF_i			-0.2532
			(0.3893)
Cons.	8.0753	8.559	14.2214
	(12.9828)	(14.1266)	(14.0122)

Equations (A1), (B1) and (C1) are the three specifications of our proposed model in equation (3.7), where equation (A1) estimates the bank-specific variables only, while industry specific and macroeconomic variables are included in equation (B1) and (C1), respectively. All explanatory variables are defined in Table3.3.
Robust standard errors are in parenthesis. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Author's calculations using Stata (v 14.0) software.

4.5.1.1. Alternative Estimation Technique

We also applied the two-stage least square (2SLS) estimation technique to confirm our main results, based on the 2-step System GMM. The results for ROAA and ROAE, as the dependant variables of Islamic bank profitability, with 2SLS estimation technique are presented in Table 4.9. The estimates obtained by 2SLS are mostly consistent with our previous findings. The

coefficient of maturity transformation risk variable (NSFR) remains statistically significant and positive in explaining Islamic banks' profitability, when measured by ROAA and ROAE, in regression equations (1) to (6). This reveals the significance of the new IFSB liquidity ratio in determining the profitability of Islamic banks. The other bank-specific explanatory variables also show similar results obtained with 2-step System GMM estimation. Moreover, the coefficient of bank concentration (3-Conc) also exhibits similar results, both in terms of significance and direction, confirming that Islamic banks tend to charge monopolistic rents in less competitive environments. In terms of the macroeconomic variables, the impact of economic growth in explaining Islamic bank profitability remains inconclusive, as the coefficient of GDP growth rate shows a positive and significant effect on profitability when measured by ROAA. However, it is insignificant in explaining profitability in terms of ROAE. In addition, the inflation variable remains insignificant in determining the profitability of Islamic banks during the sample period.

Table 4.9 Two Stage Least Square (2SLS) Estimation Results (Maturity Transformation Risk and Islamic Banks' Profitability Model)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
$ROAA_{it-1}$	0.363***	0.469***	0.457***			
	(0.113)	(0.112)	(0.115)			
$ROAE_{it-1}$				0.460***	0.451***	0.448***
				(0.131)	(0.130)	(0.128)
$NSFR_{it}$	0.773**	0.567*	0.576*	8.711**	8.455**	8.729**
	(0.360)	(0.330)	(0.332)	(4.095)	(4.027)	(4.176)
CAP_{it}	0.0528**	0.0803***	0.0770***	0.346*	0.397*	0.374*
	(0.0206)	(0.0243)	(0.0239)	(0.207)	(0.215)	(0.221)
ln_TA_{it}	0.106	0.355*	0.395**	3.248**	4.704**	4.698**
	(0.151)	(0.196)	(0.197)	(1.647)	(1.929)	(2.109)
$NONII\_TA_{it}$	0.298**	0.201*	0.210*	0.117	0.282	0.287
	(0.126)	(0.117)	(0.117)	(0.840)	(0.827)	(0.817)
EFF_{it}	-0.0212***	-0.0210***	-0.0206***	-0.234***	-0.231***	-0.232***
	(0.00521)	(0.00497)	(0.00493)	(0.0505)	(0.0496)	(0.0500)
$LLRTL_{it}$	-0.0359	-0.0245	-0.0252	-1.125**	-1.161**	-1.168**
	(0.0273)	(0.0267)	(0.0266)	(0.568)	(0.563)	(0.565)
3_CONC_{it}		0.00649*	0.00833**		0.128***	0.125***
		(0.00392)	(0.00422)		(0.0424)	(0.0427)
GDP_t			0.0331**			-0.0293
			(0.0154)			(0.159)
INF_t			0.00108			0.0639
			(0.0190)			(0.181)
R-squared	0.577	0.554	0.563	0.474	0.484	0.486
Hansen J statistics	4.589	4.448	4.570	6.932	8.308	8.727
	p = 0.3321	p = 0.4869	p = 0.4706	p = 0.2729	p = 0.3062	p = 0.2729
Number of Banks	55	55	55	55	55	55
Observations	412	412	412	412	412	412

Robust standard errors are in parenthesis. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Author's calculations using Stata (v 14.0)

4.5.2 Post Estimation Tests for Validity of 2-step System GMM Dynamic Panel Data Analysis

A summary of the post estimation tests used to verify the validity of the two-step System GMM estimators, utilizing ROAA and ROAE as dependent variables, in the maturity transformation risk and Islamic banks' profitability model are presented in Tables 4.9 and 4.10, respectively. The F-statistics of all regression models are highly significant at the 1% significance level. Thus, the joint null hypothesis that all estimated coefficients are jointly equal to zero is rejected.

4.5.2.1 Test for Autocorrelation

The validity of two-step System GMM estimation is assessed through the number of instruments used, AR(2), Hansen *J* and Difference-in-Hansen tests. The AR(1) tests' z-statistics are negative and statistically significant in all the specifications of our model, defined in equation (3.6). This indicates the presence of the negative first-order autocorrelation among idiosyncratic disturbances in difference. However, the z-statistics of the AR(2) tests in all specifications are insignificant, with p-values 0.575, 0.328,and 0.410 in Table 4.9 and p-values 0.438, 0.322 and 0.150 in Table 4.10, respectively. Therefore, it is not possible to reject the null hypothesis of no second-order serial correlation in idiosyncratic errors in first difference. This result indicates the nonexistence of the first-order autocorrelation in their levels. Thus, lags from period two or earlier in levels could be employed as instruments in the differenced equation (Roodman, 2009b). In other words, the results support the choice of lags from period 2 and earlier, as valid instruments in this study.

4.5.2.2 Test for Over-identification and Exogeneity of Instruments

The Hansen tests of over-identification in Table 4.9 reveal the *J*-statistics of 8.12 (*p*-value = 0.322), 6.41 (*p*-value = 0.379) and 5.42 (*p*-value = 0.712) in equation (A), (B) and (C), respectively. Similarly, Table 4.10 reports the Hansen *J* test statistics of 2.26 (*p*-value = 0.812), 1.63 (*p*-value = 0.897) and 2.88 (*p*-value = 0.824) in equation (A1), (B1) and (C1), respectively. P-values greater than 10% indicate that the null hypothesis of the exogeneity of all instruments as a group can be accepted. Furthermore, to test the exogeneity of instrument subsets, the Difference-in-Hansen tests were conducted. All *p*-values of the Difference-in-Hansen test statistics for all specifications, in both Tables 4.9 and 4.10, are insignificant (with $p > 0.10$). Therefore, there is no evidence to reject the null hypothesis of exogeneity of

instruments subsets. Hence, the results of both the Hansen test and the Difference-in-Hansen test support the exogeneity of instrumental variables used in all the specifications. In addition, the number of instruments was kept smaller than the number of groups as recommended by Roodman (2009b). Conclusively, all post-estimation specification tests strongly support the validity of the two-step System GMM estimators.

Table 4.10 Post-estimation Specification Tests (ROAA as the Dependent Variable in Maturity Transformation Risk and Profitability Model)

	(A)	(B)	(C)
F-Statistics	272.67 p = 0.000	145.57 p = 0.000	167.79 p = 0.000
AR(1) test stat	-2.66 p > z = 0.008	-3.17 p > z = 0.002	-3.20 p > z = 0.001
AR(2) test stat	-0.56 p > z = 0.575	-0.98 p > z = 0.328	-0.82 p > z = 0.410
Hansen *J*-stat	8.12 p > z = 0.322	6.41 p > z = 0.379	5.42 p > z = 0.712
Difference-in-Hansen tests			
- *GMM instruments for levels*	χ^2 (2) = 2.75 p > z = 0.253	χ^2 (2) = 3.28 p > z = 0.194	χ^2 (2) = 1.84 p > z = 0.399
No. of Instruments	15	15	19
No. of Banks	55	55	55
Observations	412	412	412

Source: Author's calculations using Stata (v 14.0) software

Table 4.11 Post-estimation Specification Tests (ROAE as the Dependent Variable in Maturity Transformation Risk and Profitability Model)

	(A1)	(B1)	(C1)
F-Statistics	45.70 p = 0.000	45.51 p = 0.000	52.10 p = 0.000
AR(1) test stat	-1.99 p > z = 0.046	-1.95 p > z = 0.051	-1.86 p > z = 0.062
AR(2) test stat	0.78 p > z = 0.438	0.97 p > z = 0.332	1.44 p > z = 0.150
Hansen *J*-stat	2.26 p > z = 0.812	1.63 p > z = 0.897	2.88 p > z = 0.824
Difference-in-Hansen test			
- *GMM instruments for levels*	χ^2 (2) = 0.93 p > z = 0.627	χ^2 (2) = 0.23 p > z = 0.889	χ^2 (2) = 2.50 p > z = 0.287
No. of Instruments	13	14	17
No. of Banks	55	55	55
Observations	412	412	412

Source: Author's calculations using Stata (v 14.0) software

4.6 Estimation Results – Maturity Transformation Risk and Islamic Banks' Stability Model

This section provides empirical evidence for the effect of maturity transformation risk on the stability of Islamic banks. For empirical estimations, we applied three specifications to our regression model (equation (3.11)). First, we estimated the regression model using only bank specific variables. For the second and third specifications, we included industry-specific and macroeconomic variables in the regression model, respectively. Table 4.12 presents the two-step System GMM dynamic panel data estimation results of "Maturity Transformation Risk and Islamic Banks' Stability" model, using natural log of Z-score (ln_Z-score) as the dependent variable. Equation (A) in Table 4.12, shows the effect of maturity transformation risk and other bank-specific variables on the stability of Islamic banks. We also controlled for the industry-specific effects on Islamic banks' stability in equation (B). The model was re-estimated after controlling for the macroeconomic factors, in addition to the bank-specific and industry-specific explanatory variables in equation (C).

Table 4.12 Estimations based on Natural Log of Z score (ln_Z-score$_{it}$) as the Dependent Variable using Two-step System GMM Model

	(A)	(B)	(C)
ln_Z-score$_{it-1}$	0.6723 ***	0.2849 ***	0.5804 ***
	(0.1355)	(0.1001)	(0.1584)
NSFR$_{it}$	0.6647 ***	0.7952 ***	0.5958 ***
	(0.2106)	(0.2368)	(0.1903)
SIZE$_{it}$	0.097 *	0.0235	0.1172 **
	(0.0554)	(0.0753)	(0.0497)
CAP$_{it}$	0.0127 *	0.0108	0.0035
	(0.007)	(0.0099)	(0.0061)
NONII_TA$_{it}$	-0.12 *	-0.1698 **	-0.1551 ***
	(0.0646)	(0.0766)	(0.0537)
EFF$_{it}$	-0.0017	-0.0036 *	-0.0025
	(0.0056)	(0.0019)	(0.0018)
LLRTL$_{it}$	-0.047 **	-0.0569 **	-0.047 ***
	(0.0197)	(0.0238)	(0.0113)
3_CONC$_{it}$		0.0066 **	0.0078 **
		(0.0033)	(0.003)
ECON_F$_{it}$			-0.0295 **
			(0.0113)
GDP$_{i}$			-0.009 *
			(0.005)
INF$_{i}$			0.0062
			(0.0111)
Cons.	-0.6648	0.6587	1.0703
	(1.0519)	(0.9401)	(0.9063)

Equations (A), (B) and (C) are the three specifications of our proposed model in equation (3.11), where equation (A) estimates the bank-specific variables only, while industry specific and macroeconomic variables are included in equations (B) and (C), respectively. All explanatory variables are defined in Table 3.5.
Robust standard errors are in parenthesis. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Author's calculations using Stata (v 14.0) software.

The estimation results reported in Table 4.12 are mainly in line with our expectations. The coefficient of the lagged dependent variable remains positive and highly significant at a 1% significance level, in all three specifications. This confirms the dynamic characteristic of our model, which implies that the stability factor of previous year, significantly affects the current year stability of Islamic banks, especially during the sample period.

The results of our regression model also show that the maturity transformation risk, as measured by NSFR, is a significant determinant in explaining the stability of Islamic banks. The

positive sign of the NSFR coefficient, in all regression specifications, is consistent with our expectations, as summarized in Table 3.4. The coefficient γ_1 takes the value of 0.66, 0.79 and 0.59 in equations (A), (B) and (C), respectively, and remains highly significant at a 1% level in all three model specifications. Since maturity transformation risk decreases with an increase in net stable funding ratio, the regression results reveal an inverse relationship between exposure to maturity transformation risk and the stability of Islamic banks. Our empirical findings endorse the adoption of this new IFSB liquidity regulatory requirement by Islamic banks, which can significantly improve their stability through appropriate adjustments in maturities of their balance sheet components, on both assets and liability sides. Our findings are consistent with Ashraf et al.'s (2016) study, which argued that the inclusion of NSFR would lead to an increased in the financial stability of Islamic banks, by reducing the maturity mismatch of their assets and liabilities. A higher value of NSFR depicts the lower maturity mismatch between the components on both sides of the balance sheet, thus enabling banks to meet their funding requirements, when needed. This subsequently reduces their potential risk of *"run on banks"* and hence, they demonstrate greater stability. Our findings also find support from the Basel Committee on Banking Supervision (BCBS), which emphasized that core deposits are more stable than both short and long-term wholesale funding (BIS, 2009). Therefore, banks which rely more on market funding possess a lower net stable funding ratio and a higher degree of maturity transformation risk, which consequently reduces their stability. Similarly, a decrease in required amount of stable funding through more short-term financing activities and an increased proportion of less risky investments can help Islamic banks to achieve higher levels of stability.

The estimation results in Table 4.12 show that the coefficients of bank-specific factors are largely consistent with our expectations, thus providing empirical support for our hypotheses. Bank size (SIZE) shows a positive impact on stability of Islamic banks in all regression equations. The SIZE coefficient is statistically significant at 10% and 5% in equations (A) and (C), respectively. This implies that larger Islamic banks show more stability in terms of their probability of default, as compared to smaller banks. In a recent study, Ashraf et al. (2016) stressed that larger Islamic banks, which maintain the regulatory requirement of net stable funding ratio of more than 100%, are more stable than smaller Islamic banks. Since, the banks included in our sample on average, maintain the ratio well above the minimum regulatory

requirement during the study period, our estimation results remain consistent with Ashraf et al.'s (2016) findings.

Our results are also similar to the findings of Ibrahim and Rizvi (2017), who concluded that bank size has a significant and positive influence on the stability of Islamic banks, once they reach to a certain threshold asset size. A possible reason that our estimated SIZE coefficient remains positive in all regression specifications is that almost all of our sample banks have asset sizes of more than US$ 324 million (a threshold of bank's asset size calculated by Ibrahim and Rizvi (2017), beyond which the SIZE coefficient shows a positive influence on stability of Islamic Banks). However, our results contradict those of Čihák and Hesse (2010). They argue that sized banks are more stable than larger Islamic banks. One possible explanation could be the difference in the study periods. The authors also did not consider the dynamic relationship, nor did they control for the potential sources of endogeneity among the regressors and the dependent variable.

Among the other bank-specific explanatory variables, both income diversification (NONII) and credit risk (LLRTL) are associated with lower stability of the Islamic banks. The coefficient of NONII takes the value of -0.12, -0.17 and -0.16 in regression specification (A), (B) and (C) in Table 4.12, respectively, and shows an increased significance level after controlling for industry-specific and macroeconomic factors. Our results suggest that the increased reliance of bank management on revenue from non-traditional banking activities significantly reduces the stability of Islamic banks. This negative diversification – stability relationship can be explained in terms of the high volatility of income generated from diversified activities, as highlighted by Busch and Kick (2009) and Stiroh (2006), as well as its contribution towards systemic risk (Brunnermeier et al., 2012). The other reason could be that Islamic banks tend to over-diversify when they possess little expertise and experience in market-oriented diversified activities. This leads to higher risks. We find support for our estimation results from the previous studies of Abedifar et al. (2013) and Čihák and Hesse (2010), where the authors concluded that Islamic banks, which are heavily reliant on diversified income sources, are less stable. Our results are also consistent with the findings of previous studies on the conventional banking system (for example Chiaramonte et al., 2015; Demirgüç-Kunt & Huizinga, 2010a; Mercieca et al., 2007). In their studies, the authors make clear that an increase in shares of non-interest income increases the banks' insolvency risk, due to high

volatility in returns. However, our results contradict the empirical findings of Ashraf et al. (2016), where the authors explain that an increase in shares of diverse income sources significantly improves the stability of Islamic banks.

The measure of asset quality, loan loss reserves to total assets ($LLRTL$), remains significant and negatively associated with the bank stability measure in our regression models, providing robust empirical evidence that banks with higher credit risk are more unstable. The coefficient of $LLRTL$ takes the values of -0.047, -0.056 and -0.047 in regression equations (A), (B) and (C), respectively. The significance level also increased from 5% to 1%, after controlling for both industry-specific and macroeconomic variables in equation (C). Since the higher value of $LLRTL$ reflects poor asset quality, or in other words, it corresponds to a higher credit risk, our estimation results suggest that the stability of Islamic banks significantly decreases with deteriorating asset quality. Our findings are similar Trad et al.'s (2017), who assert that the stability of Islamic banks is a reflection of the bank's better asset quality.

Although the coefficients of bank capitalization (CAP) and management efficiency (EFF) are consistent with our assumption, in terms of direction, , the impact of both variables remains inconclusive on stability, as they lose their significance after controlling for industry and macroeconomic variables. Hence, we could not find any empirical evidence in support of bank capital and management efficiency in explaining the stability of Islamic banks.

Our results show that the bank concentration 3_CONC variable is significantly associated with the increased stability of Islamic banks at a 5% level, and remains consistent after controlling for country level macroeconomic conditions. This positive concentration – stability relationship implies that Islamic banks are more stable in less competitive industries and increased competition attracts financial fragility. This can be explained by the reason that Islamic banking is still in its infancy stage in most of our sample countries. The regulatory support provided by the governments in terms of restricted entry and high capital requirements provide better profit opportunities, capital buffers to macroeconomic and liquidity shocks and consequently fewer incentives to take aggressive risks, with positive repercussions for financial stability. Our results are consistent with the findings of previous studies on the concentration – stability nexus, for example Ali, Intissar, and Zeitun (2018), Beck, De Jonghe, and Schepens (2013) and Berger, Klapper, and Ariss (2009), where the

authors concluded that the likelihood of financial stability increases in a more concentrated market, through increased profitability and capitalization.

Among the macroeconomic factors, the overall economic freedom and growth in gross domestic product are significant factors in explaining the stability of Islamic banks. However, we find no empirical evidence regarding the significant impact of inflation on bank stability. In a stark contrast to our expectations, the coefficient of economic freedom (ECO_F) takes the value of -0.029 and is significant at a 5% level, suggesting that the regulatory restrictions significantly contribute towards the increased stability of Islamic banks. Similarly, the fragility of Islamic banks increases in a more deregulated environment. We find support for our estimation results from the recent study of Asteriou et al. (2016), who argue that greater economic freedom has adverse effects on the financial stability of middle income countries and stricter regulations have a positive impact on the stability of larger banks. A possible reason could be that with more economic freedom, it is easier to enter the sector. This results in increased levels of market competition, consequently worsening the average profitability of banks. This may lead to increased bank risk appetite, thus inducing financial fragility. Moreover, banks in a deregulated economy tend to invest in more short-term unsecure risky assets to obtain higher profits. While doing so, their credit risk increases, which in turn lead to the higher probability of bank default. The results support our previous argument that Islamic banks are more likely to be stable in concentrated markets, where it is also easier for regulators to monitor bank performance, thus ensuring their stability. However, Moghadam (2015) provided contradictory results and argued that banks with higher freedom to undertake intermediation activities can achieve economies of scale and thus are more efficient and stable. In a similar vein, Baier et al. (2012) found that the probability of financial crisis is likely to be less in economies with greater levels of economic freedom.

Contrary to our expectations, the growth in gross domestic product (GDP) also shows a significant negative relationship with the stability of Islamic banks, implying that the stability of Islamic banks is adversely affected during the period of economic growth. Although the previous studies of Köhler (2015), Diaconu and Oanea (2014), and Sufian and Habibullah (2012) argue that better economic conditions improve bank loan quality. Additionally, during periods of economic upturn, banks are encouraged to lend more and thus are more stable. However, our findings of the negative economic growth – stability relationship suggest that

larger Islamic banks lack management skills and expertise to maintain the overall asset quality (Beck et al., 2013), which result in increased credit risks and thus impedes their stability.

4.6.1 Robustness Analysis

We run several specifications tests to confirm the robustness of our main results. Table 4.13 shows the results of various regression specifications. The results presented in equations (1) and (2) in Table 4.13 were obtained after interacting maturity transformation risk $(NSFR)$ with bank size $(SIZE)$ and economic freedom(ECO_F), respectively. The positive significant coefficient of $NSFR \times SIZE$ in equation (1) shows that the marginal impact of NSFR on stability increases with an increase in bank size, providing support for our main findings. The positive moderating effect of the interaction term suggests that larger Islamic banks, which maintain the regulatory requirements of NSFR are more stable. Moreover, the coefficient of NSFR x ECO_F is negative and significant in equation (2), provides evidence of the negative moderating role of this interaction term on the stability of Islamic banks. This suggests that the marginal effect of NSFR on the stability of Islamic banks significantly diminishes in more deregulated environments.

We further utilize four different measures of economic freedom; that is, business freedom (BUS_F), monetary freedom (MON_F), financial freedom (FIN_F) and freedom from corruption (COR_F), alternatively in our regression model to determine the consistency of our main findings. The results are reported in equations (3), (4), (5) and (6), respectively. The results obtained are largely consistent with our main findings (see Table 4.12). The NSFR coefficient remains significant and positive in all our regression specifications, providing strong support for the inclusion of new IFSB liquidity requirement for Islamic banking stability. Moreover, income diversification, asset quality and bank concentration remain consistent in explaining the stability of Islamic banks. The negative and significant coefficients of both business freedom (BUS_F) and financial freedom (FIN_F) are consistent with our expectations. The results further strengthen our argument that banks operating in economies with more freedom are prone to financial instability. Therefore, more regulations are required to maintain banking system stability. Our results also suggest that a lesser degree of government intervention in determining the country's monetary policy also enhances the financial stability of Islamic banks. Similarly, the significantly positive coefficient of freedom from corruption

(COR_F) also suggests that the banking system is more stable in economies with lower corruption levels.

Table 4.13 Robustness Analysis: ln_Zscore$_{it}$ as the Dependent Variable in Maturity Transformation Risk and Banks' Stability Model

	(1)	(2)	(3)	(4)	(5)	(6)
Ln_Zscore$_{it-1}$	0.6531 ***	0.8959 ***	0.3432 ***	0.4027 ***	0.5276 ***	0.3089 ***
	(0.2223)	(0.2499)	(0.1275)	(0.1454)	(0.1246)	(0.105)
NSFR$_{it}$	-3.384 *	7.3867 **	0.9337 ***	0.8532 **	0.4827 **	0.9174 ***
	(1.8665)	(3.4944)	(0.2577)	(0.3907)	(0.2221)	(0.2807)
SIZE$_{it}$	-0.4983 *	0.0854	0.1471 **	-0.0067	0.1209 *	-0.0179
	(0.282)	(0.0797)	(0.0646)	(0.116)	(0.0637)	(0.0567)
CAP$_{it}$	0.014	0.0173	0.0163 *	0.0082	0.0018	0.0069
	(0.0156)	(0.0111)	(0.009)	(0.0092)	(0.0075)	(0.0082)
NONII_TA$_{it}$	-0.1456 **	-0.0534	-0.1408 **	-0.1849 *	-0.0697	-0.1116 *
	(0.0718)	(0.0813)	(0.0643)	(0.0999)	(0.0612)	(0.0587)
EFF$_{it}$	-0.0012	-0.0001	-0.0023	-0.0034 **	-0.0012	-0.0032 **
	(0.002)	(0.002)	(0.0015)	(0.0015)	(0.0019)	(0.0014)
LLRTL$_{it}$	-0.041 ***	-0.0418 ***	-0.0661 ***	-0.0632 ***	-0.0477 ***	-0.0669 ***
	(0.0141)	(0.0142)	(0.0125)	(0.0178)	(0.0137)	(0.0089)
3_CONC$_{it}$	0.0051 **	0.008 **	0.0056 **	0.0054	0.0088 **	0.004
	(0.0025)	(0.0036)	(0.0027)	(0.0036)	(0.0035)	(0.0025)
ECO_F$_t$	-0.0199	0.1523 *				
	(0.0135)	(0.0857)				
NSFR$_{it}$ x SIZE$_{it}$	0.5147 **					
	(0.2545)					
NSFR$_{it}$ x ECO_F$_t$		-0.1265 **				
		(0.0622)				
BUSS_F$_t$			-0.0108 **			
			(0.0054)			

MON_F_t				0.033 **		
				(0.0138)		
FIN_F_t					-0.0119 **	
					(0.0059)	
$CORR\_F_t$						0.0083 *
						(0.0049)
GDP_t	-0.0111 **	-0.0044	-0.0166 ***	-0.0165 **	-0.0089 *	-0.0164 ***
	(0.0055)	(0.0072)	(0.0061)	(0.0072)	(0.0049)	(0.0054)
INF_t	0.0177	-0.0074	0.0180	0.0193	0.0029	0.0170
	(0.0172)	(0.0175)	(0.012)	(0.0181)	(0.0105)	(0.0126)
Cons.	4.9094 **	-9.8575 *	-0.1198	-1.7694	-0.1009	0.5725
	(2.4179)	(5.1912)	(0.8962)	(1.5577)	(0.7443)	(0.7579)

Columns (1) and (2) are the two specifications of our regression model (equation (3.11)) with two interaction terms $NSFR_{it}$ x $SIZE_{it}$ and $NSFR_{it}$ x ECO_F_t, respectively. Column (3) to (6) report the results of our specifications after including $BUSS\_F_t$, MON_F_t, FIN_F_t, and $CORR\_F_t$, respectively. All explanatory variables are defined in Table 3.5.
Robust standard errors are in parenthesis. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Author's calculations using Stata (v 14.0) software.

4.6.2 Post Estimation Tests for Validity of 2-step System GMM Dynamic Panel Data Analysis

The validity of two-step System GMM estimation is assessed with the number of instruments used, in AR(2), Hansen *J* and Difference-in-Hansen tests. Tables 4.14 presents a summary of the post estimation tests to verify the estimates obtained by the two-step System GMM estimation technique, utilizing ln_Zscore as the dependent variables in the maturity transformation risk and Islamic bank stability model. The validity of our estimation results, obtained for robustness analysis, are presented in Table 4.15. The F-statistics of all regression models are highly significant at the 1% significance level. This rejects the null hypotheses that all estimated coefficients are jointly equal to zero, in all model specifications.

4.6.2.1 Tests for Autocorrelation

The AR(1) tests' z-statistics are negative and statistically significant in all the specifications of our model defined in equation (3.11), and indicate the presence of the negative first-order autocorrelation among idiosyncratic disturbances in difference. However, z-statistics of the AR(2) tests in all specifications are insignificant with p-values 0.983, 0.319, and 0.557 in Table 4.14 and p-values 0.935, 0.517, 0.246, 0.268, 0.630 and 0.248 in Table 4.15, respectively. Therefore, the null hypothesis of no second-order serial correlation in idiosyncratic errors is accepted, indicating the nonexistence of first-order autocorrelation in their levels. This also confirms our choice of the number of lags selection from period $t-2$ or earlier in levels, which can be used as valid instruments in the differenced equation (Roodman, 2009b).

4.6.2.2 Tests for Over-identification and Exogeneity of Instruments

The test statistics of the Hansen test of over-identification in Table 4.14, reveal the *J*-statistics of 13.90 (*p*-value = 0.519), 5.11 (*p*-value = 0.954) and 9.75 (*p*-value = 0.637) in equations (A), (B) and (C), respectively. Similarly, Table 4.15 reports the Hansen *J* test statistics of 12.36 (*p*-value = 0.652), 2.59 (*p*-value = 0.763), 2.46 (*p*-value = 0.982), 4.66 (*p*-value = 0.794), 12.83 (*p*-value = 0.381), and 6.83 (*p*-value = 0.968) in equation (1) to (6), respectively. The *p*-values greater than 10% indicate that the null hypothesis of the exogeneity of all instruments as a group can be accepted. Furthermore, to test the exogeneity of instrument subsets, Difference-in-Hansen tests were conducted. All *p*-values of the Difference-in-Hansen test statistics for all specifications in both Tables 4.14 and 4.15 are insignificant (with p > 0.10). There is no evidence to reject the null hypothesis of exogeneity of instruments subsets. Hence, the results

of both the Hansen *J* test and the Difference-in-Hansen test support the exogeneity of instrumental variables used in all the regression specifications. In addition, the number of instruments is kept smaller than the number of groups as recommended by Roodman (2009b). Conclusively, all post-estimation specification tests strongly support the validity of our estimation results utilizing the two-step System GMM estimation technique.

Table 4.14 Post-estimation Specification Tests – ln_Zscore as the Dependent Variable in "Maturity Transformation Risk and Islamic Banks' Stability" Model

	(A)	(B)	(C)
F-Statistics	18.23 $p = 0.000$	16.86 $p = 0.000$	23.13 $p = 0.000$
AR(1) test stat	-1.68 $p > z = 0.092$	-1.69 $p > z = 0.092$	-1.72 $p > z = 0.085$
AR(2) test stat	-0.02 $p > z = 0.983$	-1.00 $p > z = 0.319$	-0.59 $p > z = 0.557$
Hansen *J*-stat	$\chi^2(14) = 13.09$ $p > z = 0.519$	$\chi^2(2) = 5.11$ $p > z = 0.954$	$\chi^2(12) = 9.75$ $p > z = 0.637$
Difference-in-Hansen test			
- *GMM instruments for levels*	$\chi^2(2) = 1.65$ $p > z = 0.438$	$\chi^2(2) = 1.78$ $p > z = 0.620$	$\chi^2(3) = 1.03$ $p > z = 0.793$
- *IV*	$\chi^2(4) = 7.40$ $p > z = 0.116$	$\chi^2(2) = 2.20$ $p > z = 0.820$	$\chi^2(8) = 8.14$ $p > z = 0.420$
No. of Instruments	22	21	24
No. of Banks	55	55	55
Observations	412	412	412

Source: Author's calculations using Stata (v 14.0) software

Table 4.15 Two-step System GMM Post-estimation Specification Tests – Robustness Analysis of Maturity Transformation Risk and Banks' Stability Model

	(1)	(2)	(3)	(4)	(5)	(6)
F-Statistics	39.77 $p = 0.000$	16.86 $p = 0.000$	44.13 $p = 0.000$	33.98 $p = 0.000$	24.15 $p = 0.000$	56.83 $p = 0.000$
AR(1) test stat	-1.53 $p > z = 0.126$	-1.50 $p > z = 0.134$	-1.73 $p > z = 0.084$	-1.71 $p > z = 0.088$	-1.68 $p > z = 0.093$	-1.81 $p > z = 0.070$
AR(2) test stat	-0.08 $p > z = 0.934$	0.65 $p > z = 0.517$	-1.16 $p > z = 0.246$	-1.11 $p > z = 0.268$	-0.48 $p > z = 0.630$	-1.15 $p > z = 0.248$
Hansen *J*-stat	$\chi^2(15) = 12.36$ $p > z = 0.652$	$\chi^2(5) = 2.59$ $p > z = 0.763$	$\chi^2(9) = 2.46$ $p > z = 0.982$	$\chi^2(8) = 4.66$ $p > z = 0.794$	$\chi^2(12) = 12.83$ $p > z = 0.381$	$\chi^2(15) = 6.83$ $p > z = 0.962$
Difference-in-Hansen test						
- *GMM instruments for levels*	$\chi^2(3) = 0.68$ $p > z = 0.877$	$\chi^2(3) = 1.67$ $p > z = 0.643$	$\chi^2(3) = 1.38$ $p > z = 0.709$	$\chi^2(3) = 3.66$ $p > z = 0.301$	$\chi^2(3) = 1.76$ $p > z = 0.623$	$\chi^2(3) = 0.70$ $p > z = 0.874$
No. of Instruments	28	18	21	20	24	27
No. of Banks	55	55	55	55	55	55
Observations	412	412	412	412	412	412

Source: Author's' calculations using Stata (v 14.0) software

Chapter 5

Summary and Conclusion

5.1 Introduction

This chapter provides a summary of the present study. Section 5.2 details the focus of the study. Section 5.3 summarizes the empirical findings of the study. Section 5.4 provides the policy implications of the research results. Section 5.5 discusses contributions to the literature. Section 5.6 presents the limitations of this study, while recommendations for future research are provided in section 5.7.

5.2 Focus of the Study

In the wake of the 2007-08 global financial crisis, maturity transformation risk has come to the attention of regulators, who have called for improved bank liquidity management practices. To harmonize the robust management and monitoring of maturity transformation risk in the Islamic banking industry, the Islamic Financial Services Board (IFSB), the standards setting body for Islamic financial institutions, endorsed the Basel III liquidity regulations. The IFSB recommended the implementation of a modified net stable funding ratio ($NSFR$), as a structural measure for the maturity transformation function for Islamic banks, to account for their unique balance sheet structure. This micro-prudential measure of maturity transformation risk prohibits the banks from excessive reliance on unstable short-term funds (Arvanitis & Drakos, 2015), which adversely effects performance and stability of the Islamic banking sector. In other words, this new regulatory requirement is designed to manage the bank's liquidity position in the long run, by introducing continuous structural changes in the bank's balance sheet, to fund their activities with more stable funding sources. This study has investigated the factors that are significantly associated with the maturity transformation risk in Islamic banks, and explored the relationship of maturity transformation risk with the profitability and stability of the Islamic banking sector. More specifically, this study has answered the following three questions.

Question 1:

What are the factors that significantly influence the maturity transformation risk in the Islamic banking sector?

Question 2:

How is maturity transformation risk associated with the financial performance of Islamic banks?

Question 3:

Does the inclusion of net stable funding ratio contribute towards the improved stability of Islamic banks?

To explore the above research questions, we developed three empirical models; that is the "*determinants of maturity transformation risk*" model, the "*maturity transformation risk and Islamic banks' profitability*" model and the *"maturity transformation risk and Islamic banks' stability"* model, respectively. The data required to achieve these objectives was sourced from the Bloomberg database and cross checked with the publicly available banks' consolidated annual reports. We used unconsolidated data where banks' consolidated information was not reported in the annual reports. In addition, we used hand collected relevant financial information from banks' annual reports and followed the ISFB Guidance Note No. 6, to calculate the NSFR. The sample period of the study was from 2006 to 2015, and comprised of 55 fully fledged Islamic banks, from 11 different countries. A two-step system GMM dynamic panel data estimation technique and various pre- and post-estimation diagnostic tests were used to investigate the research questions and to check the validity of the models employed in the study. Moreover, this study employed alternative estimation techniques, such as quantile regression and two-stage least squares, to check the robustness of the main findings.

5.3 Summary of Empirical Findings

This section summarizes the empirical findings of the three models used in this study. Before examining these relationships, based on dynamic panel data analysis, this study applied several pre-estimation diagnostic tests to check for the presence of potential unit root, multicollinearity, individual effects, heteroscedasticity and serial-correlation problems. We utilized the Fisher-type ADF test to check for the presence of unit root in our dataset, which can produce spurious regression results. The results in Appendix Table B.1 show that there is no unit root problem in the data set, which suggests that the mean and variance does not depend on time, hence the regression analysis can produce meaningful results (Gujarati, 2009). The Pearson pair-wise correlation test results in Appendix Tables B.2.1 to B.2.3 show

that there is a significant correlation among the explanatory variables in all three models, which prompts further empirical investigation. The results indicate no correlation among the regressors exceeds the value of 0.80, which suggests the non-existence of multicollinearity among the selected variables (Gujarati, 2009). The individual fixed effects are confirmed in the three regression models, as the Hausman test *p*-values reported in Appendix Tables B.3.1 to B.3.2 remain at a significance level of less than 10%. Moreover, the results of Breusch-Pagan test for heteroscedasticity and the Wooldridge test for serial-correlation reported in Appendix Tables B.4 and B.5, respectively, also confirm that residuals are not identically distributed and are correlated with the explanatory variables, in all model specifications. The dynamic nature of the three regression models used in this study, was confirmed by introducing lagged dependent variable in pooled OLS[10]. However, the inclusion of lagged dependent variable causes a simultaneity problem, in which case the results obtained through pooled OLS and or fixed effects estimation techniques will not be consistent and efficient. To address the issues of heteroscedasticity, serial correlation and potential endogeneity, this study utilized the two-step system GMM dynamic panel data estimation technique. The summary of the empirical results for the *"determinants of maturity transformation risk"* model is presented in section 5.3.1. The empirical findings for *"maturity transformation risk and Islamic banks' profitability"* model and the *"maturity transformation risk and Islamic banks' stability"* model, are summarized in sections 5.3.2 and 5.3.3, respectively.

5.3.1 Summary Findings of the "Determinants of Maturity Transformation Risk" Model

The first objective of this study was to determine the influence of various bank-specific and macroeconomic variables on maturity transformation risk in the Islamic banking sector. Table 5.1 summarizes the results obtained for the "determinants of maturity transformation risk" model. The table shows that the lagged dependent variable is highly significant in all model specifications, thus confirming the dynamic nature of our model. Among the bank-specific factors, bank size (SIZE), capital (CAP) and external funding dependence (NDD and STB) have a significant and positive impact on maturity transformation risk in Islamic banks, during the sample period, when the net stable funding ratio (NSFR) is used as the dependent variable. The results remained consistent after utilizing financing gap ratio (FGR) as an alternative

[10] The R-square value increases significantly when the lagged dependent variables are introduced into the individual POLS regression model. For brevity, test results are not presented, since this is not the scope of the present study. However, the results can be made available upon request.

measure of maturity transformation risk. Bank profitability (ROAA), liquid assets (both less-risky and risky liquid assets scales on total assets) and market power (MP) also show significant impact on maturity transformation risk in the sample banks, but in the opposite direction.

Table 5.1 Summary of Empirical Findings using Two-step Robust System GMM – "Determinants of Maturity Transformation Risk" Model

	NSFR		FGR	
	(A)	(B)	(A1)	(B1)
$NSFR_{it-1}$	(+)***	(+)***		
FGR_{it-1}			(+)***	(+)***
$SIZE_{it}$	(-)**	(-)***	(+)**	(+)**
CAP_{it}	(-)***	(-)***	(+)***	(+)***
$ROAA_{it}$	(+)***	(+)**	(-)	(-)
$LRLA\_TA_{it}$	(+)***	(+)***	(-)***	(-)***
RLA_TA_{it}	(+)***	(+)***	(+)***	(+)***
MP_{it}	(+)	(+)**	(-)***	(-)***
$LLRTL_{it}$	(+)	(+)	(+)**	(+)**
NDD_{it}	(-)***	(-)***	(+)***	(+)***
STB_{it}	(-)***	(-)**	(+)***	(+)**
GDP_i		(-)		(-)
INF_i		(-)**		(+)*

Note: (+) and (-) represent the direction of relationship with dependent variable. Model specifications are discussed in Tables 4.2 and 4.3.
***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Source: Author's calculations using Stata (v 14.0) software.

Among the macroeconomic variables, consumer price index, as a measure of inflation (INF) significantly affects the maturity transformation risk in Islamic banks during the sample period. Consistent results were obtained after utilizing the alternative measure of maturity transformation risk. Further, we could not find any evidence of the influence of bank credit risk (LLRTL) in determining maturity transformation risk (NSFR as the dependent variable). Moreover, we did not find any evidence for the impact of growth in gross domestic product (GDP) on maturity transformation risk in the sample banks, during the study period.

5.3.2 Summary Findings of the "Maturity Transformation Risk and Islamic Banks' Profitability" Model

The second objective of this study was to investigate the relationship between maturity transformation risk and the profitability of Islamic banks. Table 5.2 summarizes the empirical results obtained based on the two-step robust system GMM dynamic panel data estimation technique. The highly significant and positive lagged dependent variable in all regression specifications implies that the profitability of Islamic banks persists over time. As expected, the NSFR remains significant in explaining the increasing profitability of Islamic banks. Therefore, we suggest that the profitability of Islamic banks is significantly affected by their level of maturity transformation risk exposure. Our results remain robust even after controlling for industry and macroeconomic factors, and also after utilizing ROAE as an alternative measure of bank profitability. NSFR remains significant, both in direction and magnitude, in explaining the Islamic banks' profitability. Moreover, various factors at bank, industry and country levels, included in the regression specifications, are consistent with our expectations. More specifically, bank capitalization (CAP) shows a positive and significant relationship with the profitability of Islamic banks, in all regression models. Similarly, bank concentration (3_CONC) also remains significant in determining the increased financial performance of our sample banks. On the contrary, management efficiency (EFF) and loan loss reserves (LLRLTL) remain significant and negative while explaining Islamic bank profitability, during the study period.

However, the relationship of bank size (SIZE), income diversification (NONII_TA) growth in gross domestic product (GDP) and inflation (INF) with the profitability of Islamic banks remain inconclusive, as they lose their significance when alternative profitability measures are applied. Both, SIZE and GDP are significant and positive in determining the banks' profitability, when using ROAA as the dependent variable. Although the direction remains consistent, they lose their significance power in explaining financial performance, when ROAE is used as an alternative profitability measure. Furthermore, the direction of the relationship between inflation and profitability remains negative. But it is only significant in explaining Islamic banks' profitability, when ROAA is used as the dependent variable. Similarly, income diversification shows a significant relationship with Islamic banks' profitability, only when ROAE is utilized as the dependent variable. It shows no significant relationship with ROAA.

Table 5.2 Summary of Empirical Findings using Two-step Robust System GMM – "Maturity Transformation Risk and Islamic Banks' Profitability" Model

	ROAA			ROAE		
VARIABLES	(A)	(B)	(C)	(A1)	(B1)	(C1)
$ROAA_{it-1}$	(+)***	(+)***	(+)***			
$ROAE_{it-1}$				(+)***	(+)***	(+)***
$NSFR_{it}$	(+)**	(+)**	(+)**	(+)*	(+)*	(+)*
CAP_{it}	(+)*	(+)***	(+)***	(+)***	(+)***	(+)***
$SIZE_{it}$	(+)	(-)**	(-)**	(+)	(-)	(-)
$NONII\_TA_{it}$	(+)	(+)	(+)	(+)*	(+)**	(+)**
EFF_{it}	(-)***	(-)	(-)*	(-)***	(-)***	(-)***
$LLRTL_{it}$	(-)**	(-)***	(-)***	(-)**	(-)**	(-)***
3_CONC_{it}		(+)***	(+)**		(+)*	(+)**
GDP_t			(+)***			(+)
INF_t			(-)*			(-)

Note: (+) and (-) represent the direction of relationship with the dependent variable. Model specifications are discussed in Tables 4.7 and 4.8.
***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Source: Author's calculations using Stata (v 14.0) software.

5.3.3 Summary Finding of the "Maturity Transformation Risk and Islamic Banks' Stability" Model

The last objective of this study examined the relationship between maturity transformation risk and the stability of Islamic banks. To answer this objective, we applied the two-step robust system GMM dynamic panel data estimation technique. We used natural log of Z-score (ln_Z-score) to measure the stability of Islamic banks. The results are summarized in Table 5.3. The highly significant value of lagged dependent variable confirms the dynamic nature of our model specifications and provides robust empirical evidence of the persistence of stability over time, in the Islamic banking sector. The coefficient of NSFR, in all regression specifications, remains positive and highly significant in explaining the increased stability of Islamic banks, which meets our expectations and thus rejects the null hypothesis of no association between net stable funding ratio and stability, at a 1% significance level. This implies that the inclusion of new regulatory requirements have significant beneficial effects on Islamic banks' stability. Bank size (SIZE) is the other bank-specific factor, which is significant

and positively associated with the stability of Islamic banks. Moreover, 3_CONC, which is a measure of bank concentration, also impacts on the financial stability of Islamic banks. This positive concentration – stability relationship also remains significant in all of the robustness checks. In contrast, loan loss reserves (LLRTL) show a consistent negative and significant relationship with Islamic banks' stability, during the study period. Similarly, the overall economic freedom (ECO_F) and growth in gross domestic product (GDP) are among the macroeconomic factors that show significant and negative impacts on the stability of Islamic banks.

The relationship of NSFR with bank stability remains significant, even after applying a number of robustness specifications. First, we introduced four alternative measures of economic freedom in our regression model. The results presented in columns (3) to (6) in Table 5.3 reveal that the inclusion of the business freedom index (BUS_F), the monetary freedom index (MON_F), the financial freedom index (FIN_F) and the freedom from corruption index, individually in the regression model, exhibit similar effects of new liquidity regulatory requirements on the stability of Islamic banks. Next, we introduced two interaction terms ("$NSFR \times ECO\_F$" and "$NSFR \times SIZE$") to our regression model (see columns (1) and (2) in Table 5.3), and found that the effect of NSFR is more pronounced on stability, when Islamic banks operate in a more regulated environment and are larger in size.

Table 5.3 Summary of Empirical Findings using Two-step Robust System GMM – "Maturity Transformation Risk and Islamic Bank Stability" Model

	Main Findings			Robustness Analysis					
	(A)	(B)	(C)	(1)	(2)	(3)	(4)	(5)	(6)
ln_Zscore_{it-1}	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***
$NSFR_{it}$	(+)***	(+)***	(+)***	(-)*	(+)**	(+)***	(+)**	(+)**	(+)***
$SIZE_{it}$	(+)*	(+)	(+)**	(-)*	(+)	(+)**	(-)	(+)*	(-)
CAP_{it}	(+)*	(+)	(+)	(+)	(+)	(+)*	(+)	(+)	(+)
$NONII\_TA_{it}$	(-)*	(-)**	(-)***	(-)**	(-)	(-)**	(-)*	(-)	(-)*
EFF_{it}	(-)	(-)*	(-)	(-)	(-)	(-)	(-)**	(-)	(-)**
$LLRTL_{it}$	(-)**	(-)**	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***
3_CONC_{it}		(+)**	(+)**	(+)**	(+)**	(+)**	(+)	(+)**	(+)
ECO_F_t			(-)**	(-)	(+)*				
$NSFR_{it}$ x $SIZE_{it}$				(+)**					
$NSFR_{it}$ x ECO_F_t					(-)**				
$BUSS\_F_t$						(-)**			
MON_F_t							(+)**		
FIN_F_t								(-)**	
$CORR\_F_t$									(+)*
GDP_t			(-)*	(-)**	(-)	(-)***	(-)**	(-)*	(-)***
INF_t			(+)	(+)	(-)	(+)	(+)	(+)	(+)

Note: (+) and (-) represent the direction of relationship with dependent variable. Model specifications are discussed in Tables 4.12 and 4.13.
***, **, * indicate statistical significance at 1%, 5% and 10% levels, respectively.

Source: Author's calculations using Stata (v 14.0) software.

5.4 Policy Implications of the Research

The consideration on new regulatory measures for monitoring the maturity transformation function of the banking industry first began in 2010, when the Basel Committee on Banking Supervision (BCBS) proposed an updated capital and liquidity regulatory framework in its Basel III accord. This included the requirements for banks to maintain a certain level of net stable funding ratio (NSFR). While endorsing the Basel III requirements, the Islamic Financial Services Board (IFSB) instigated the implementations of the adjusted NSFR in the Islamic banking sector. The introduction of this regulatory ratio attracted significant attention from researchers, industry practitioners and regulators from both the conventional and Islamic banking sectors. These measures were seen as a positive step in reducing the possibility, to elude any future emergence of situation similar to the global financial crisis of 2007-08. This study provides several policy implications, relevant to the Islamic banking regulators and practitioners.

The study's findings reveal that holding enough liquid assets (both less-risky liquid assets and risky liquid assets), helps to maintain banks' transformation risk, at all levels. This validates the new improved liquidity requirements of IFSB, in unification with the Basel III accord, for better management of Islamic banks' liquidity. Furthermore, the excessive reliance on external funding sources, more specifically short-term market funding, increases the maturity mismatch of assets and liabilities in Islamic banks. This calls for the close monitoring of funding sources by practitioners and regulators. Additionally, we find the robust empirical evidence that larger Islamic banks tend to increase their maturity transformation function to gain higher yields and thus require adoption of improved risk management practices. The findings also reveal the need for capacity building in asset – liability management in the case of Islamic banks, which grow in their asset size. Similarly, the increased exposure of maturity transformation risk among better capitalized Islamic banks also highlight the importance of implementing strict regulations to discourage banks from excessive liquidity creation, which is consistent with the primary objective of the recent IFSB liquidity reforms. This provides support for the implementation of the adjusted net stable funding ratio in Islamic banks.

This study reports a significant, negative relationship between maturity transformation risk and profitability, which implies that the adoption of NSFR leads to a better financial performance of Islamic banks. Our findings are important for regulators and bank managers in several ways. For example, the Islamic banks, which maintain the minimum regulatory

requirement of NSFR, either generate funds from more stable sources or hold enough liquid assets to meet their customers' liquidity. While doing so, such banks are less reliant on expensive market funding and thus are more cost efficient and profitable. Therefore, the adoption of net stable funding ratio by Islamic banks can significantly improve their financial performance. The study's results did not find support for the risk-return hypothesis, since the excessive maturity transformation function by Islamic banks does not contribute to an overall increase in profitability. Besides, we found that Islamic banks, which operate on a more conservative approach, are more profitable. These findings suggest that practitioners should adjust their liquidity creation function, appropriately. Moreover, the positive capital – profitability relationship supports the implementation of improved regulatory capital requirements in Islamic banks. Our results reveal that the sound capital position of Islamic banks provide banks with ease of access to market funding at lower costs, which in turn increases their profitability. This provides some important implications, especially to the practitioners should monitor the levels of regulatory capital to avoid being under-capitalized, since bank capital is a significant factor in explaining the increased performance of Islamic banks. Furthermore, this study also suggests that policymakers of Islamic banks should focus on increasing management efficiency, introduce improved collection mechanisms, and further strengthen their customer relationships, since the CIR and LLRTL empirically reduce the profitability of Islamic banks. In addition, the positive concentration – profitability relationship warrants increased protection of the Islamic banking industry (by regulators and policymakers), to achieve better efficiency and enhanced financial performance.

This study also reports a significant, negative relationship between maturity transformation risk and the stability of Islamic banks, which implies that maintenance of the minimum regulatory NSFR requirement is important for improving the financial stability of Islamic banks, by reducing the maturity mismatch of their balance sheet components, on both the assets and liability sides. Our results strongly support the implementation of NSFR in Islamic banks and suggest that policymakers should introduce improved monitoring mechanism to ensure that Islamic banks adhere to the IFSB new liquidity regulations. This study's findings are also important for regulators to ensure that they avoid systemic risk because of the increasing interdependence of modern technology-oriented banking industry. Moreover, the significantly positive bank size and concentration relationship with stability suggests that regulators should provide appropriate protection and encourage Islamic banks to grow in their

asset size, through mergers or acquisitions, and/or by increasing their core deposit funding, to realize the benefits of scale. The study's findings also suggest that bank management should invest more in developing robust risk-mitigation tools to ensure better asset quality and the stable financial performance of Islamic banks, while giving due consideration to the unique requirements of the Islamic banking sector (for example, compliance with Sharia principles). The negative diversification – stability relationship is specifically pertinent to policymakers and bank management in that it discourages excessive reliance on non-traditional income sources.

Finally, our empirical results suggest that overall economic freedom exerts a negative impact on the stability of Islamic banks, providing support for the benefits of the regulatory interventions contention. This implies that the stability of Islamic banks is more pronounced in a regulated environment, where policymakers and regulators play an active role in monitoring and devising policies and regulations for the financial industry (such as competition level and investment risk). Economic freedom is desirable to create an environment where less regulatory control allows banks to freely engage in various non-traditional activities to benefit from scale and scope economies, and to attain greater financial performance and stability. This study's findings suggest that regulators and policymakers should ascertain a certain degree of regulatory control, as the stability of Islamic banks deteriorates when they increase their scope of operations.

5.5 Contribution to Literature

Our work contributes to the existing empirical literature in several ways. First, previous studies that focus on the determinants of maturity transformation risk primarily examine on conventional banks, from either the US or European countries, where the capital market structure is well developed with different dynamics than in developing countries (see for example, Gobat, Yanase, & Maloney, 2014; Giordana & Schumacher, 2013; Angora & Roulet, 2011; BIS, 2010). This may allow banks in the US and Europe easy access to external funding sources for their liquidity management. Our study contributes to the existing literature strand on maturity transformation risk by including a completely different banking system, that is, the Islamic banking system, and use bank data, from developing countries, where the banking system is the main source of private business financing. This allows us to examine the impact of operation and market restrictions, with regards to Shari'ah compliant financial instruments, as well as macroeconomic factors, on the maturity transformation function of Islamic banks.

Second, existing studies that examine the intermediation functions of Islamic banks, and in particular, the liquidity management requirements, theoretically or empirically, are either restricted to one country or are descriptive in nature (Bacha, 2008; Brown et al., 2007; Iqbal & Molyneux, 2005; Rosly, 2005Khan & Ahmed, 2001). This is the first study that focuses on the measurement of maturity transformation risk and its determinants in Islamic banks which operate in different countries in terms of the IFSB's new liquidity regulations.

Third, this study finds a positive impact of the IFSB's proposed NSFR on the profitability and stability of Islamic banks. The study's findings contribute to the growing strand of literature on bank liquidity creation and maturity transformation risk in Islamic banking. The study used hand-collected data from consolidated annual reports of Islamic banks to calculate the new liquidity regulatory measure based on IFSB's GN-6 guidelines. This study also contributes to existing strands of literature on profitability and the stability of Islamic banks, by investigating the effect of NSFR as a new prudential structural measure of liquidity, while controlling for various factors at firm, country and industry levels.

Finally, to the best of our knowledge, this is the first study that attempts to utilize state of the art two-step system GMM dynamic panel data estimation techniques, to account for the lagged effects of explanatory variables on maturity transformation risk, as well as the profitability and stability of Islamic banking system, to address the issues of potential endogeneity, heteroscedasticity and autocorrelation. This enables our study to quantify the most efficient estimates of the factors that affect maturity transformation risk, and the profitability and stability of Islamic banks.

5.6 Limitations

This study has several limitations, all of which suggest directions for future research. The first limitation of this study relates to the availability of data that is necessary to accomplish the research objectives identified in Chapter One. The data used for this study was derived from the published consolidated annual reports of 55 fully-fledged retail Islamic banks, from 11 different countries, which is not a complete representation of the Islamic banking industry. One of the primary objectives of this study was to calculate the IFSB's proposed NSFR, for which we needed to extract relevant financial information from banks' annual reports. For this reason, we restricted our sample size to Islamic banks whose consolidated annual reports are publicly available in English, with a disclosure statement (maturities of assets and liabilities),

from their websites. Our final dataset is unbalanced panel data because the annual reports of some of the selected banks are not publicly available, for the complete ten years. For future research, we recommend accessing multiple data sources, such as Datastream and Bankscope, so as to generate a more representative sample of the Islamic banking industry.

The other limitation of this study relates the accurate calculation of NSFR, following the IFSB guidelines. Although GN-6 issued by the IFSB provides comprehensive quantitative guidelines, the major limitation in calculating the NSFR is the lack of available granular data on liquidity risk reporting across Islamic banks. This study adopts Ashraf et al.'s (2016) methodology to compute the NSFR variable, and made several assumptions with respect to the category and maturity of various balance sheet items of Islamic banks. The assumptions made in assigning factors to relevant balance sheet items may affect the accuracy measurement of the maturity transformation risk of the sampled banks, according to the IFSB's guidelines.

Third, only accounting based measures were used in this study to determine the profitability and stability of Islamic banks. However, because of the limited study period and the lack of publicly available data on Islamic banking, market based profitability measures, such as Tobin's Q and market-based stability measures, such as Merton's DD and credit default swap (CDS) spreads, are not included in this study. For this reason, it is difficult to draw a definitive conclusion, since accounting based data do not take market variables into account.

5.7 Future Research Directions

The results presented of this study suggest several important avenues for further research surrounding the IFSB's new liquidity measure for the Islamic banking industry. First, as highlighted earlier, the availability of existing data to measure IFSB's proposed NSFR is limited and is one of the challenges in this field of research. We recommend further research to remedy this issue. More specifically, researchers should try to obtain data on Islamic investment banks and Islamic windows, and attempt to assess the impact of NSFR on the profitability and stability of Islamic banks with respect to the business model. The findings may be useful in drawing definitive conclusions on the influence of new regulatory measures on the profitability and stability of the overall Islamic banking sector.

We also recommend subsequent researchers obtain frequent quarterly data on Islamic banks. This information will help researchers to examine, more extensively, the effects of various

factors (at a bank-level, industry-level and country-level), on maturity transformation risk, and the profitability and stability of Islamic banks. In-depth analysis may provide fruitful suggestions for regulators and practitioners regarding better monitoring and regulation practices around the maturity transformation function of Islamic banks and their impact on financial performance and stability.

Finally, as highlighted earlier, in addition to the accounting measures, future research should include various market measures for profitability and stability. Analysing the financial performance and stability of Islamic banks using both accounting and market measures, can help researcher draw definitive conclusions regarding the influence of IFSB's proposed NSFR on both the profitability and stability of the Islamic banking sector.

Appendix A

IFSB GN-6 Weights to Balance Sheet Items of Islamic Banks

Table A.1 Summary of Factors Assigned to Balance Sheet Items in Calculating IFSB Net Stable Funding Ratio

Components of ASF Category	ASF Factor
Placements from Financial Institutions< 1 Year	0.50
Placements from Financial Institutions > 1 Year	1.0
Fund Borrowing < 1 Year	0.50
Fund Borrowing > 1 Year	1.0
Customer Current Accounts	0.50
Term Deposits < 1 Year	0.90
Term Deposits > 1 Year	0.95
Subordinated Mudarbah Sukuk < 1 Year	0.50
Subordinated Mudarbah Sukuk > 1 Year	1.0
Other Liabilities > 1Year	1.0
Equity of Investment Account Holders > 1Year	0.95
Equity of Investment Account Holders< 1Year	0.90
Interbank Mudarbah Investments < 1 Year	0.50
Interbank Mudarbah Investments > 1 Year	1.0
Total Owner's Equity	1.0
Components of RSF Category	**RSF Factor**
Government Sukuk > 1 Year	0.05
Placements with Financial Institutions/Murabaha and Wakala	0.50
Placements with Financial Institutions/Murabaha and Wakala	1.0
Corporate Sukuk < 1 Year	0.50
Corporate Sukuk > 1 Year	1.0
Investments Securities > 1 Year	0.50
Investments in Real Estate/Investment Property > 1 Year	0.65
Sales Receivables < 1 Year	0.85
Sales Receivables > 1 Year	1.0
Financing Assets < 1 Year	0.85
Financing Assets > 1 Year	1.00
Ijara Muntahia Bittamleek < 1 Year	0.85
Ijara Muntahia Bittamleek > 1 Year	1.00
Assets Acquired for Leasing < 1 Year	0.85
Assets Acquired for Leasing > 1 Year	1.00
Ijara Income Receivable < 1 Year	0.85
Ijara Income Receivable > 1 Year	1.00
Fixed Assets	1.0
Other Assets	1.0
OBS	0.05

Appendix B

Pre-estimation Diagnostic Tests

B.1 Fisher-Type Unit Root Test

Table B.1 presents the Augmented Dicky-Fuller Unit Root tests of variables included in our three regression models (equations (3.6), (3.7) and (3.11)).

Table B.1 Augmented Dicky-Fuller Unit Root Test for Panel Stationarity

Variable	Acronym	Inv. χ^2	*p*-value	Mod. χ^2	*p*-value
Maturity Transformation	NSFR	447.2656	0.0000	22.7384	0.0000
Risk	FGR	296.5205	0.0000	12.5752	0.0000
Profitability	ROAA	583.7121	0.0000	31.9377	0.0000
	ROAE	421.4763	0.0000	20.9997	0.0000
Stability	ln_Zscore	268.4117	0.0000	10.6801	0.0000
Bank Size	ln_TA	227.5155	0.0000	7.9229	0.0000
Bank Capitalization	CAP	286.7022	0.0000	11.9133	0.0000
Income Diversification	NONII_TA	570.6904	0.0000	31.0597	0.0000
Operating Efficiency	EFF	435.2583	0.0000	21.9289	0.0000
Credit Risk	LLRTL	332.2949	0.0000	14.9871	0.0000
Less Risky Liquid Assets	LRLA_TA	309.6574	0.0000	13.4609	0.0000
Risky Liquid Assets	RLA_TA	440.3469	0.0000	22.2720	0.0000
Non-Deposit Dependence	NDD	398.7701	0.0000	19.4689	0.0000
Short-term borrowing	STB_CDTB	462.5838	0.0000	23.7712	0.0000
Market Share	MP	291.2479	0.0000	12.2197	0.0000
Bank Concentration	3_Conc	257.8267	0.0000	9.9665	0.0000
Economic Growth	GDPG	245.7437	0.0000	9.5976	0.0000
Inflation	CPI	561.1361	0.0000	31.2589	0.0000
Economic Freedom	ECO_F	160.2732	0.0013	3.3894	0.0004
Freedom from Corruption	CORR_F	212.3337	0.0000	6.8993	0.0000
Business Freedom	BUSS_F	285.1926	0.0000	11.8115	0.0000
Monetary Freedom	MON_F	188.5116	0.0000	5.2932	0.0000
Financial Freedom	FIN_F	132.5754	0.0704	1.5220	0.0640

Source: Author's calculations using Stata (v14.0)

B.2 Pearson Pairwise Test for Panel Correlation

Table B.2.1 Pearson Pairwise Correlation among the variables used in Determinants of Maturity Transformation Risk Model

	NSFR	FGR	ln_TA	CAP	ROA	LRLA_TA	RLA_TA	MP	LLRLT	NDD	STB	GDP	CPI
NSFR	1												
FGR	0.893**	1											
	0.000												
ln_TA	-0.287**	0.382**	1										
	0.000	*0.000*											
CAP	0.040	0.141**	-0.312**	1									
	0.385	*0.002*	*0.000*										
ROA	0.024	0.225**	0.227**	0.092*	1								
	0.599	*0.000*	*0.000*	*0.046*									
LRLA_TA	0.049	0.041	0.264**	-0.238**	0.077	1							
	0.294	*0.373*	*0.000*	*0.000*	*0.096*								
RLA_TA	0.546**	-0.159**	-0.252**	0.185**	-0.034	-0.313**	1						
	0.000	*0.001*	*0.000*	*0.000*	*0.464*	*0.000*							
MP	-0.077	0.193**	0.640**	-0.092*	0.075	-0.002	0.085	1					
	0.095	*0.000*	*0.000*	*0.047*	*0.105*	*0.971*	*0.066*						
LLRLT	0.199**	-0.039	0.041	-0.133**	-0.210**	0.057	0.329**	0.116*	1				
	0.000	*0.402*	*0.376*	*0.004*	*0.000*	*0.216*	*0.000*	*0.012*					
NDD	-0.105*	0.435**	0.140**	0.196**	0.072	0.023	0.227**	0.196**	-0.114*	1			
	0.023	*0.000*	*0.002*	*0.000*	*0.122*	*0.616*	*0.000*	*0.000*	*0.013*				
STB	-0.160**	0.442**	0.151**	0.132**	0.004	-0.006	0.195**	0.210**	-0.110*	0.896**	1		
	0.001	*0.000*	*0.001*	*0.004*	*0.924*	*0.905*	*0.000*	*0.000*	*0.017*	*0.000*			
GDP	0.091*	-0.041	-0.066	0.175**	0.279**	-0.096*	0.061	-0.002	-0.118*	-0.058	-0.059	1	
	0.048	*0.381*	*0.157*	*0.000*	*0.000*	*0.036*	*0.189*	*0.959*	*0.011*	*0.212*	*0.206*		
CPI	0.226**	-0.326**	-0.383**	-0.111*	-0.105*	-0.117*	0.178**	-0.168**	0.174**	-0.254**	-0.282**	0.040	1
	0.000	*0.000*	*0.000*	*0.016*	*0.022*	*0.011*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.385*	

Source: Author's calculations using Stata (v 14.0) software.

All variables are defined in Table 3.2. *p*-values are in *italics.* * and ** indicate 5% and 1% significance levels.

Table B.2.2 Pearson Pairwise Correlation among the variables used in Maturity Transformation Risk and Profitability Model

	ROAA	ROAE	NSFR	ln_TA	CAP	NII_TA	EFF	LLRTL	3_Conc	GDP	CPI
ROAA	1										
ROAE	0.720**	1									
	0.000										
NSFR	0.024	0.027	1								
	0.599	*0.568*									
ln_TA	0.227**	0.195**	-0.287**	1							
	0.000	*0.000*	*0.000*								
CAP	0.092*	-0.025	0.040	-0.312**	1						
	0.046	*0.592*	*0.385*	*0.000*							
NONII_TA	0.386**	0.166**	0.150**	-0.045	0.140**	1					
	0.000	*0.000*	*0.001*	*0.330*	*0.002*						
EFF	-0.583**	-0.640**	0.029	-0.418**	0.199**	-0.012	1				
	0.000	*0.000*	*0.531*	*0.000*	*0.000*	*0.795*					
LLRTL	-0.210**	-0.497**	0.199**	0.041	-0.133**	0.130**	0.306**	1			
	0.000	*0.000*	*0.000*	*0.376*	*0.004*	*0.005*	*0.000*				
3_Conc	0.090	-0.020	-0.190**	0.224**	0.059	-0.144**	-0.112*	0.070	1		
	0.051	*0.660*	*0.000*	*0.000*	*0.202*	*0.002*	*0.015*	*0.132*			
GDP	0.279**	0.132**	0.091*	-0.066	0.175**	0.025	-0.152**	-0.118*	-0.020	1	
	0.000	*0.004*	*0.048*	*0.157*	*0.000*	*0.586*	*0.001*	*0.011*	*0.662*		
CPI	-0.105*	-0.102*	0.226**	-0.383**	-0.111*	0.131**	0.274**	0.174**	-0.280**	0.040	1
	0.022	*0.027*	*0.000*	*0.000*	*0.016*	*0.005*	*0.000*	*0.000*	*0.000*	*0.385*	

Source: Author's calculations using Stata (v 14.0) software.
All variables are defined in Table 3.3. *p*-values are in *italics.* * and ** indicate 5% and 1% significance levels.

Table B.2.3 Pearson Pairwise Correlation among the variables used in Maturity Transformation Risk and Stability Model

	ln_Zscore	NSFR	ln_TA	CAP	NII_TA	EFF	LLRTL	3_Conc	GDP	CPI	ECO_F	CORR_F	BUSS_F	MON_F	FIN_F
ln_Zscore	1														
NSFR	-0.012	1													
	0.791														
ln_TA	-0.008	-0.287*	1												
	0.856	*0.000*													
CAP	0.180*	0.040	-0.312*	1											
	0.000	*0.385*	*0.000*												
NONII_TA	-0.069	0.150*	-0.045	0.140*	1										
	0.136	*0.001*	*0.330*	*0.002*											
EFF	-0.341*	0.029	-0.418*	0.199*	-0.012	1									
	0.000	*0.531*	*0.000*	*0.000*	*0.795*										
LLRTL	-0.352*	0.199*	0.041	-0.133*	0.130*	0.306*	1								
	0.000	*0.000*	*0.376*	*0.004*	*0.005*	*0.000*									
3_Conc	-0.042	-0.190*	0.224*	0.059	-0.144*	-0.112*	0.070	1							
	0.363	*0.000*	*0.000*	*0.202*	*0.002*	*0.015*	*0.132*								
GDP	0.078	0.091*	-0.066	0.175*	0.025	-0.152*	-0.118*	-0.020	1						
	0.092	*0.048*	*0.157*	*0.000*	*0.586*	*0.001*	*0.011*	*0.662*							
CPI	-0.160*	0.226*	-0.383*	-0.111*	0.131*	0.274*	0.174*	-0.280*	0.040	1					
	0.001	*0.000*	*0.000*	*0.016*	*0.005*	*0.000*	*0.000*	*0.000*	*0.385*						
ECO_F	-0.016	-0.400*	0.498*	0.147*	-0.147*	-0.200*	0.001	0.544*	-0.033	-0.581*	1				
	0.723	*0.000*	*0.000*	*0.001*	*0.001*	*0.000*	*0.979*	*0.000*	*0.476*	*0.000*					
CORR_F	0.083	-0.341*	0.556*	0.138*	-0.083	-0.335*	-0.022	0.517*	0.094*	-0.523*	0.817*	1			
	0.072	*0.000*	*0.000*	*0.003*	*0.074*	*0.000*	*0.641*	*0.000*	*0.041*	*0.000*	*0.000*				
BUSS_F	-0.036	-0.048	0.298*	0.064	-0.069	-0.119*	-0.042	0.292*	-0.007	-0.337*	0.571*	0.311*	1		
	0.439	*0.297*	*0.000*	*0.170*	*0.139*	*0.010*	*0.362*	*0.000*	*0.886*	*0.000*	*0.000*	*0.000*			
MON_F	0.265*	-0.309*	0.265*	0.043	0.094*	-0.222*	-0.175*	0.300*	0.018	-0.419*	0.533*	0.523*	0.184*	1	
	0.000	*0.000*	*0.000*	*0.359*	*0.041*	*0.000*	*0.000*	*0.000*	*0.701*	*0.000*	*0.000*	*0.000*	*0.000*		
FIN_F	-0.132*	-0.356*	0.250*	0.186*	-0.064	-0.031	0.050	0.397*	-0.046	-0.413*	0.808*	0.496*	0.454*	0.342*	1
	0.004	*0.000*	*0.000*	*0.000*	*0.168*	*0.504*	*0.278*	*0.000*	*0.323*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	

Source: Author's calculations using Stata (v 14.0) software.

All variables are defined in Table 3.4. *p*-values are in *italics.* * and ** indicate 5% and 1% significance levels.

B.3 Selection of Fixed or Random Effects Model

Table B.3.1 Hausman Test for Determinants of Maturity Transformation Risk Model (Dependent Variable: NSFR)

	-------- Coefficients --------			
	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
$SIZE_{it}$	-0.0705	-0.0806	0.0101	0.0112
CAP_{it}	0.0020	0.0010	0.0010	0.0006
$ROAA_{it}$	0.0202	0.0201	0.0001	0.0009
$LRLA\_TA_{it}$	0.0200	0.0203	-0.0003	0.0004
RLA_TA_{it}	0.0188	0.0188	0.0000	0.0001
MP_{it}	-0.0071	-0.0008	-0.0063	0.0049
$LLRTL_{it}$	0.0025	0.0021	0.0004	0.0002
NDD_{it}	-0.0029	-0.0038	0.0009	0.0003
GDP_{jt}	-0.0004	-0.0002	-0.0002	0.0001
INF_{jt}	-0.0094	-0.0088	-0.0006	0.0004

χ^2 (11) = 42.92
Prob >χ^2 = 0.0000

Table B.3.2 Hausman Test for Maturity Transformation Risk and Bank's Profitability Model (Dependent Variable: ROAA)

	-------- Coefficients --------			
	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
$NSFR_{it}$	0.4327	0.2873	0.1454	0.1413
$SIZE_{it}$	0.0283	0.1841	-0.1558	0.1463
CAP_{it}	0.0452	0.0445	0.0007	0.0077
$NONII\_TA_{it}$	0.6164	0.5758	0.0406	0.0222
EFF_{it}	-0.0303	-0.0325	0.0022	0.0011
$LLRTL_{it}$	-0.0473	-0.0404	-0.0070	0.0041
3_Conc_{it}	-0.0024	0.0038	-0.0062	0.0037
GDP_{jt}	0.0524	0.0672	-0.0148	0.0050
INF_{jt}	0.0222	0.0276	-0.0054	0.0065

χ^2 (9) = 38.06
Prob >χ^2 = 0.0000

Table B.3.3 Hausman Test for Maturity Transformation Risk and Bank's Stability Model (Dependent Variable: ln_Zscore)

	-------- Coefficients --------			
	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
$NSFR_{it}$	-3.0696	-3.2104	0.1408	0.3602
$SIZE_{it}$	-2.9610	-3.8959	0.9349	0.5944
CAP_{it}	0.9424	0.9085	0.0339	0.0255
$NONII\_TA_{it}$	-0.9851	-1.0455	0.0604	0.0549
EFF_{it}	-0.0293	-0.0345	0.0051	0.0026
$LLRTL_{it}$	0.1937	0.1981	-0.0044	0.0070
3_Conc_{it}	0.0018	-0.0172	0.0190	0.0140
ECO_F_{jt}	0.0335	0.0301	0.0034	0.0608
GDP_{jt}	-0.0390	-0.0601	0.0212	0.0170
INF_{jt}	-0.0985	-0.1356	0.0371	0.0116

χ^2 (10) = 13.42

Prob >χ^2 = 0.0210

B.4 Breusch-Pagan/Cook Weisberg Test for Heteroskedasticity

Table B.4.1 Modified Wald Test Statistics for Group-wise Heteroskedasticity

Model	Dep. Var.	χ^2	Prob >χ^2
Determinants of Maturity Transformation Risk Model	NSFR	1.2e+05	0.0000
	FGR	82362.01	0.0000
Maturity Transformation Risk and Bank Profitability Model	ROAA	18160.20	0.0000
	ROAE	15173.64	0.0000
Maturity Transformation Risk and Bank Stability Model	ln_Zscore	38440.70	0.0000

Source: Author's calculations using Stata (v 14.0) software.

B.5 Wooldridge Test for Autocorrelation

Table B.5.1 Wooldridge Test for Autocorrelation in Panel Data

Model	Dep. Var.	F stats	Prob >F
Determinants of Maturity Transformation Risk Model	NSFR	36.760	0.0000
	FGR	263.235	0.0000
Maturity Transformation Risk and Bank Profitability Model	ROAA	49.477	0.0000
	ROAE	29.515	0.0000
Maturity Transformation Risk and Bank Stability Model	ln_Zscore	10.653	0.0019

Source: Author's calculations using Stata (v 14.0) software.

References

Abduh, M., & Idrees, Y. (2013). Determinants of Islamic Banking Profitability in Malaysia. *Australian Journal of Basic and Applied Sciences, 7*(2), 204-210.

Abedifar, P., Molyneux, P., & Tarazi, A. (2013). Risk in Islamic Banking. *Review of Finance, 17*(6), 2035-2096.

Abreu, M., & Mendes, V. (2001). *Commercial Bank Interest Margins and Profitability: Evidence for Some EU Countries. The* Pan-European Conference: The Ssaloniki, Greece.

Acharya, V. V., Hasan, I., & Saunders, A. (2006). Should Banks Be Diversified? Evidence from Individual Bank Loan Portfolios. The *Journal of Business, 79*(3), 1355-1412.

Acharya, V. V., Mehran, H., & Thakor, A. V. (2016). Caught Between Scylla and Charybdis? Regulating Bank Leverage When the re is Rent Seeking and Risk Shifting. The *Review of Corporate Finance Studies, 5*(1), 36-75.

Acharya, V. V., & Mora, N. (2015). A Crisis of Banks As Liquidity Providers. The *Journal of Finance, 70*(1), 1-43.

Acharya, V. V., & Viswanathan, S. (2011). Leverage, Moral Hazard, and Liquidity. The *Journal of Finance, 66*(1), 99-138.

Akhtar, M. F., Ali, K., & Sadaqat, S. (2011). Factors Influencing the Profitability of Islamic Banks of Pakistan. International *Research Journal of Finance and Economics, 66*, 125-132.

Akram, Q. F., & Eitrheim, Ø. (2008). Flexible Inflation Targeting and Financial Stability: Is It Enough to Stabilize Inflation and Output? *Journal of Banking & Finance, 32*(7), 1242-1254. doi:https://doi.org/10.1016/j.jbankfin.2007.10.008

Al-Jafari, M. K., & Alchami, M. (2014). Determinants of Bank Profitability: Evidence from Syria. *Journal of Applied Finance and Banking, 4*(1), 17-45.

Al-Khouri, R. (2012). Bank Characteristics and Liquidity Transformation: the Case of GCCBanks. International *Journal of Economics and Finance, 4*(12), 114-120.

Alexiou, C., & Sofoklis, V. (2009). Determinants of Bank Profitability: Evidence from the Greek Banking Sector. *Economic Annals, 182*, 93-118.

Alharbi, A. T. (2017). Determinants of Islamic Banks' Profitability: International Evidence. International *Journal of Islamic and Middle Eastern Finance and Management, 10*(3), 331-350.

Ali, M. S. B., intissar, T., & Zeitun, R. (2018). Banking Concentration and Financial Stability. New Evidence from Developed and Developing Countries. *Eastern Economic Journal, 44*(1), 117-134.

Allen, F., Carletti, E., & Marquez, R. (2011). Credit Market Competition and Capital Regulation. The *Review of Financial Studies, 24*(4), 983-1018.

Allen, F., & Gale, D. (2004). Competition and Financial Stability. *Journal of Money, Credit and Banking, 36*(3), 453-480. doi:10.1353/mcb.2004.0038

Alman, M., & Oehler, A., &. (2012). *Liquidity Transformation Factors of Islamic Banks: An Empirical Analysis.* European Financial Management Association 2011 Annual Meetings: Braga, Portugal.

Almazari, A. A. (2014). Impact of Internal Factors on Bank Profitability: Comparative Study Between Saudi Arabia and Jordan. *Journal of Applied Finance and Banking, 4*(1), 125-140.

Altunbas, Y., Manganelli, S., & Marques-Ibanez, D. (2011). *Bank Risk During the Financial Crisis: Do Business Models Matter? Ecb Working Paper 1394*. Retrieved from http://ssrn.com/abstract_id=1787593

Alzoubi, T. (2017). Determinants of Liquidity Risk in Islamic Banks. *Banks and Bank Systems, 12*(3), 142-148. Doi:10.21511/Bbs.12(3).2017.10

Angora, A., & Roulet, C. (2011). Transformation Risk and Its Determinants: A New Approach Based on the Basel III Liquidity Management Framework. *Universite De Limoges.*

Archer, S., & Karim, R. A. A. (2013). *Islamic Finance: the New Regulatory Challenge*. John Wiley & Sons.

Arellano, M., & Bond, S. (1991). Some Tests of Specification For Panel Data: Monte Carlo Evidence and An Application to Employment Equations. The *Review of Economic Studies, 58*(2), 277-297.

Arellano, M., & Bover, O. (1995). Another Look At the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics, 68*(1), 29-51.

Ariffin, N. M. (2012). Liquidity Risk Management and Financial Performance in Malaysia: Empirical Evidence from Islamic Banks. *Aceh International Journal of Social Science, 1*(2), 77-84. doi: https://doi.org/10.12345/aijss.1.2.1530

Arvanitis, P., & Drakos, K. (2015). The Net Stable Funding Ratio of Us Bank Holding Companies: A Retrospective Analysis. International *Journal of Economic Sciences, 4*(2), 1-9.

Ashraf, D., Rizwan, M. S., & L'huillier, B. (2016). A Net Stable Funding Ratio For Islamic Banks and Its Impact on Financial Stability: An International investigation. *Journal of Financial Stability, 25*, 47-57.

Aspachs, O., Nier, E., & Tiesset, M. (2005). Liquidity, Banking Regulation and the Macroeconomy. Evidence on Bank Liquidity Holdings from A Panel of Uk-Resident Banks. *Unpublished Manuscript. BIS*. Retrieved from https://ssrn.com/abstract=673883

Asteriou, D., Pilbeam, K., & Tomuleasa, I. (2016). The *Impact of Economic Freedom, Business Regulation and Corruption on Bank Profitability and Bank Stability: Evidence from Europe.* Retrieved from http://openaccess.city.ac.uk/id/eprint/16839

Asutay, M., & Izhar, H. (2007). Estimating the Profitability of Islamic Banking: Evidence from Bank Muamalat Indonesia. *Review of Islamic Economics, 11*(2), 17-29.

Athanasoglou, P., Brissimis, S., & Delis, M. (2008). Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability. *Journal of International Financial Markets,Institutions and Money, 18*(2), 121-136.

Athanasoglou, P., Delis, M., & Staikouras, C. (2006). Determinants of Bank Profitability in the South Eastern European Region. Bank of Greece Working Paper No. 47.

Audretsch, D. B., & Elston, J. A. (2002). Does Firm Size Matter? Evidence on the Impact of Liquidity Constraints on Firm investment Behavior in Germany. International *Journal of Industrial Organization, 20*(1), 1-17.

Bacha, O. I. (2008). The Islamic inter Bank Money Market and A Dual Banking System: the Malaysian Experience. International *Journal of Islamic and Middle Eastern Finance and Management, 1*(3), 210-226.

Baier, S. L., Clance, M., & Dwyer, G. P. (2012). Banking Crises and Economic Freedom. *2012 Economic Freedom Dataset, Published in Economic Freedom of the World: 2012 Annual Report*.

Baltagi, B. (2008). *Econometric Analysis of Panel Data.* 4th Ed. Chicchester: John Wiley & Sons.

Bashir, A. H. M. (2003). Determinants of Profitability in Islamic Banks: Some Evidence from the Middle East. *Islamic Economic Studies, 11*(1), 31-57.

Baum, C. F. (2006). *An introduction to Modern Econometrics Using Stata.* Texas, USA: Stata Press.

Baum, C. F. (2013). *Quantile Regression*. Retrieved from: http://fmwww.bc.edu/ec-c/s2013/823/ec823.s2013.nn04.slides.pdf

Beck, T., De Jonghe, O., & Schepens, G. (2013). Bank Competition and Stability: Cross-Country Heterogeneity. *Journal of Financial intermediation, 22*(2), 218-244. doi:https://doi.org/10.1016/j.jfi.2012.07.001

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2006). Bank Concentration, Competition, and Crises: First Results. *Journal of Banking & Finance, 30*(5), 1581-1603.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2004). Bank Competition and Access to Finance: International Evidence. *Journal of Money, Credit and Banking*, *36*(3), 627-648.

Beck, T., Demirgüç-Kunt, A., & Merrouche, O. (2013). Islamic Vs. Conventional Banking: Business Model, Efficiency and Stability. *Journal of Banking & Finance, 37*(2), 433-447.

Behr, A., Kamp, A., Memmel, C., & Pfingsten, A. (2007). *Diversification and the Banks' Risk-Return-Characteristics: Evidence from Loan Portfolios of German Banks*. Deutsche Bundesbank Series 2, Discussion Paper No. 2007-05, Banking and Financial Studies. Retreived from https://ssrn.com/abstract=2793990

Ben Khediri, K., & Ben-Khedhiri, H. (2009). Determinants of Islamic Bank Profitability in the Mena Region. International *Journal of Monetary Economics and Finance, 2*(3-4), 409-426.

Ben Naceur, S., & Kandil, M. (2009). The Impact of Capital Requirements on Banks' Cost of intermediation and Performance: the Case of Egypt. *Journal of Economics and Business, 61*(1), 70-89.

Berger, A. N., Bonime, S. D., Covitz, D. M., & Hancock, D. (2000). Why Are Bank Profits So Persistent? the Roles of Product Market Competition, Informational Opacity, and Regional/Macroeconomic Shocks. *Journal of Banking & Finance, 24*(7), 1203-1235.

Berger, A. N., & Bouwman, C. H. (2009). Bank Liquidity Creation. *Review of Financial Studies, 22*(9), 3779-3837.

Berger, A. N., & Bouwman, C. H., &. (2017). Bank Liquidity Creation, Monetary Policy, and Financial Crises. *Journal of Financial Stability, 30, 139-155*.

Berger, A. N., & Deyoung, R. (1997). Problem Loans and Cost Efficiency in Commercial Banks. *Journal of Banking & Finance, 21*(6), 849-870.

Berger, A. N., Hanweck, G. A., & Humphrey, D. B. (1987). Competitive Viability in Banking: Scale, Scope, and Product Mix Economies. *Journal of Monetary Economics, 20*(3), 501-520.

Berger, A. N., Klapper, L. F., & Ariss, R. T. (2009). Bank Competition and Financial Stability. *Journal of Financial Services Research, 35*(2), 99-118.

Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., & Stein, J. C. (2005). Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks. *Journal of Financial Economics, 76*(2), 237-269.

Bernanke, B. S. (1983). Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression. The *American Economic Review, 73*(3), 257-276.

Besanko, D., & Kanatas, G. (1996). The Regulation of Bank Capital: Do Capital Standards Promote Bank Safety? *Journal of Financial intermediation, 5*(2), 160-183.

Bhagat, S., Bolton, B., & Lu, J. (2015). Size, Leverage, and Risk-Taking of FinancialInstitutions. *Journal of Banking & Finance, 59*, 520-537. doi:https://doi.org/10.1016/j.jbankfin.2015.06.018

Bhattacharya, S., Boot, A. W., & Thakor, A. V. (1998). The Economics of Bank Regulation. *Journal of Money, Credit and Banking*, *30*(4), 745-770.

Bhattacharya, S., & Gale, D. (1985). Preference Shocks, Liquidity, and Central Bank Policy.

Bhattacharya, S., & Thakor, A. V. (1993). Contemporary Banking Theory. *Journal of Financial intermediation, 3*(1), 2-50.

BIS (2009). Strengthening the Resilience of the Banking Sector. *Consultative Document, BIS, December*. Retrieved from https://www.bis.org/publ/bcbs164.pdf

BIS (2010). International *Framework For Liquidity Risk Measurement, Standards and Monitoring-Consultative Document*. Retrieved from https://www.bis.org/publ/bcbs165.pdf

Blum, J. (1999). Do Capital Adequacy Requirements Reduce Risks in Banking? *Journal of Banking & Finance, 23*(5), 755-771.

Blundell, R., & Bond, S. (1998). initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics, 87*(1), 115-143.

Bolt, W., De Haan, L., Hoeberichts, M., Van Oordt, M. R., & Swank, J. (2012). Bank Profitability During Recessions. *Journal of Banking & Finance, 36*(9), 2552-2564.

Bond, S. R. (2002). Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice. *Portuguese Economic Journal, 1*(2), 141-162.

Bonfim, D., & Kim, M. (2012). *Liquidity Risk in Banking: Is the re Herding?* European Banking Center Discussion Paper 2012-18. Retrieved from https://www.bportugal.-pt/sites/default/files/anexos/papers/wp201218.pdf.

Boot, A. W., & Thakor, A. V. (2000). Can Relationship Banking Survive Competition? the *Journal of Finance, 55*(2), 679-713.

Bordeleau, É., & Graham, C. (2010). The *Impact of Liquidity on Bank Profitability*: Bank of Canada Working Paper (2010-38). Retrieved from https://www.bankofcanada.ca/wp-content/uploads/2010/12/wp10-38.pdf.

Bordo, M., Eichengreen, B., Klingebiel, D., & Martinez-Peria, M. S. (2001). Is the Crisis Problem Growing More Severe? *Economic Policy, 16*(32), 51-82.

Bordo, M. D. (2009). The Crisis of 2007: the Same Old Story, only the Players Have Changed. *Globalization and Systemic Risk* (Pp. 39-50). Retrieved from http://www.afi.-es/eo/l%20bordo%20the_same_old_story.pdf%2007.pdf

Bordo, M. D., & Wheelock, D. C. (1998). Price Stability and Financial Stability: the Historical Record. *Review-Federal Reserve Bank of Saint Louis, 80*, 41-60. Retrieved from https://files.stlouisfed.org/files/htdocs/publications/review/98/09/9809dw.pdf

Borio, C. (2014). The Financial Cycle and Macroeconomics: What Have We Learnt? *Journal of Banking & Finance, 45*, 182-198.

Bourke, P. (1989). Concentration and Other Determinants of Bank Profitability in Europe, North America and Australia. *Journal of Banking & Finance, 13*(1), 65-79.

Bourkhis, K., & Nabi, M. S. (2013). Islamic and Conventional Banks' Soundness During the 2007–2008 Financial Crisis. *Review of Financial Economics, 22*(2), 68-77. doi:https://doi.org/10.1016/j.rfe.2013.01.001

Boyd, J. H., De Nicoló, M. G., & Smith, M. B. D. (2003). Crisis in Competitive Versus Monopolistic Banking Systems. *Journal of Money, Credit and Banking, 36*(3), 487-506.

Boyd, J. H., & De Nicolo, G. (2005). The Theory of Bank Risk Taking and Competition Revisited. The *Journal of Finance, 60*(3), 1329-1343.

Boyd, J. H., & Graham, S. L. (1986). Risk, Regulation, and Bank Holding Company Expansion into Nonbanking. *Quarterly Review,* Federal Reserve Bank of Minneapolis, 2-17.

Boyd, J. H., & Graham, S. L. (1988). The Profitability and Risk Effects of Allowing Bank Holding Companies to Merge with Other Financial Firms: A Simulation Study. *Quarterly Review, 12*(2), 3-20.

Boyd, J. H., Hanweck, G., & Pithyachariyakul, P. (1981). *Bank Holding Company Diversification*: Banking Research Center, Graduate School of Management, Northwestern University.

Boyd, J. H., Levine, R., & Smith, B. D. (2001). The Impact of Inflation on Financial Sector Performance. *Journal of Monetary Economics, 47*(2), 221-248. doi:https://doi.org/10.1016/s0304-3932(01)00049-6

Boyd, J. H., & Prescott, E. C. (1986). Financial intermediary-Coalitions. *Journal of Economic Theory, 38*(2), 211-232.

Boyd, J. H., & Runkle, D. E. (1993). Size and Performance of Banking Firms: Testing the Predictions of Theory. *Journal of Monetary Economics, 31*(1), 47-67.

Brown, K., Hassan, M. K., & Skully, M. (2007). Operational Efficiency and Performance of Islamic Banks. in *Handbook of Islamic Banking*, (pp. 96-115).

Brunnermeier, M. K., Dong, G. N., & Palia, D. (2012). Banks' Non-Interest Income and Systemic Risk Symposium Conducted At the Meeting of the Afa 2012 Chicago Meetings Paper. Retrieved from https://scholar.princeton.edu/sites/default-/files/paper_2012-_01_31_0.pdf

Brunnermeier, M. K., & Pedersen, L. H. (2009). Market Liquidity and Funding Liquidity. *Review of Financial Studies, 22*(6), 2201-2238.

Bryant, J. (1980). A Model of Reserves, Bank Runs, and Deposit Insurance. *Journal of Banking & Finance, 4*(4), 335-344.

Busch, R., & Kick, T. (2009). Income *Diversification in the German Banking Industry*. Bundesbank Series 2, Discussion Paper No. 2009-09. Retrieved from https://ssrn.-com/abstract=2794032

Calomiris, C. W., & Gorton, G. (1991). The Origins of Banking Panics: Models, Facts, and Bank Regulation. in *Financial Markets and Financial Crises* (pp. 109-174): University of Chicago Press.

Calomiris, C. W., & Kahn, C. M. (1991). The Role of Demandable Debt in Structuring Optimal Banking Arrangements. The *American Economic Review*, *81*(3), 497-513.

Carbo-Valverde, S., Rodriguez-Fernandez, F., & Udell, G. F. (2009). Bank Market Power and SME Financing Constraints. *Review of Finance, 13*(2), 309-340.

Carletti, E., Hartmann, P., & Spagnolo, G. (2007). Bank Mergers, Competition, and Liquidity. *Journal of Money, Credit and Banking, 39*(5), 1067-1105.

Chiaramonte, L., Poli, F., & Oriani, M. E. (2015). Are Cooperative Banks A Lever For Promoting Bank Stability? Evidence from the Recent Financial Crisis in Oecd Countries. *European Financial Management, 21*(3), 491-523.

Choi, I. (2001). Unit Root Tests For Panel Data. *Journal of International Money and Finance, 20*(2), 249-272.

Chowdhury, M. A. F., & Rasid, M. E. S. M. (2015). The Determinants of the Profitability of Islamic Banks: A Cross-Sectional Study from Asia and Africa. International *Journal of Business and Globalisation, 15*(3), 375-388.

Čihák, M., & Hesse, H. (2010). Islamic Banks and Financial Stability: An Empirical Analysis. *Journal of Financial Services Research, 38*(2-3), 95-113.

Comptroller of the Currency, O. (2012). *Liquidity: Comptroller's Handbook, office of the Comptroller of the Currency, Washington Dc*. Retrieved from https://www.occ.treas.gov/publications/publications-by-type/comptrollers-handbook/liquidity/pub-ch-liquidity.pdf.

Cooper, M. J., Jackson, W. E., & Patterson, G. A. (2003). Evidence of Predictability in the Cross-Section of Bank Stock Returns. *Journal of Banking & Finance, 27*(5), 817-850.

Cottarelli, C., Dell'ariccia, G., & Vladkova-Hollar, I. (2005). Early Birds, Late Risers, and Sleeping Beauties: Bank Credit Growth to the Private Sector in Central and Eastern Europe and in the Balkans. *Journal of Banking & Finance, 29*(1), 83-104.

Coval, J. D., & Thakor, A. V. (2005). Financial intermediation As A Beliefs-Bridge Between Optimists and Pessimists. *Journal of Financial Economics, 75*(3), 535-569.

Crowe, K. (2009). Liquidity Risk Management–More Important Than Ever. *Harland Financial Solutions*.

Curak, M., Poposki, K., & Pepur, S. (2012). Profitability Determinants of the Macedonian Banking Sector in Changing Environment. *Procedia-Social and Behavioral Sciences, 44*, 406-416.

De Haan, J., & Poghosyan, T. (2012). Bank Size, Market Concentration, and Bank Earnings Volatility in the US. *Journal of International Financial Markets,Institutions and Money, 22*(1), 35-54. doi:https://doi.org/10.1016/j.intfin.2011.07.002

De Nicolo, G. (2001). *Size, Charter Value, and Risk in Banking: An International Perspective.* EFA 2001 Barcelona Meetings; FRB International Finance Discussion Paper No. 689. Retrieved from https://ssrn.com/abstract=255465

Deep, A., & Schaefer, G. (2004). *Are Banks Liquidity Transformers?* Ksg Working Paper No. Rwp04-022. Retrieved from https://ssrn.com/abstract=556289

Delechat, C. C., Arbelaez, C. H., Muthoora, M. P. S., & Vtyurina, S. (2012). The *Determinants of Banks' Liquidity Buffers in Central America*. International Monetary Fund Working Paper Wp/12/301. Retrieved from https://www.imf.org/external/pubs-/ft/wp/2012/wp12301.pdf.

Demirgüç-Kunt, A., & Detragiache, E. (1998). The Determinants of Banking Crises in Developing and Developed Countries. *Staff Papers, 45*(1), 81-109.

Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence. The *World Bank Economic Review, 13*(2), 379-408.

Demirgüç-Kunt, A., & Huizinga, H. (2013). Are Banks Too Big to Fail Or Too Big to Save? International Evidence from Equity Prices and Cds Spreads. *Journal of Banking and Finance, 37*(3), 875-894. doi: https://doi.org/10.1016/j.jbankfin.2012.10.010

Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank Activity and Funding Strategies: the Impact on Risk and Returns. *Journal of Financial Economics, 98*(3), 626-650.

Demirgüç-Kunt, A., Kane, E., & Laeven, L. (2015). Deposit Insurance Around the World: A Comprehensive Analysis and Database. *Journal of Financial Stability, 20*, 155-183. doi:https://doi.org/10.1016/j.jfs.2015.08.005

Demirguc, A., Laeven, L., & Levine, R. (2003). The *Impact of Bank Regulations, Concentration, andInstitutions on Bank Margins*: World Bank Policy Research Working Paper No. 3030. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=636392

Deng, S. E., Elyasiani, E., & Mao, C. X. (2007). Diversification and the Cost of Debt of Bank Holding Companies. *Journal of Banking & Finance, 31*(8), 2453-2473.

Deyoung, R., & Roland, K. P. (2001). Product Mix and Earnings Volatility At Commercial Banks: Evidence from A Degree of Total Leverage Model. *Journal of Financial intermediation, 10*(1), 54-84.

Deyoung, R., & Torna, G. (2013). Nontraditional Banking Activities and Bank Failures During the Financial Crisis. *Journal of Financial intermediation, 22*(3), 397-421.

Diaconu, R. I., & Oanea, D. C. (2014). The Main Determinants of Bank's Stability. Evidence from Romanian Banking Sector. *Procedia Economics and Finance, 16*, 329-335. doi:https://doi.org/10.1016/s2212-5671(14)00810-7

Diamond, D. W. (1984). Financial intermediation and Delegated Monitoring. The *Review of Economic Studies, 51*(3), 393-414.

Diamond, D. W., & Dybvig, P. H. (1983). Bank Runs, Deposit Insurance, and Liquidity. The *Journal of Political Economy, 91*(3), 401-419. doi:https://doi.org/10.1086/261155

Diamond, D. W., & Rajan, R. G. (2000). A Theory of Bank Capital. The *Journal of Finance, 55*(6), 2431-2465.

Diamond, D. W., & Rajan, R. G. (2001). Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking. *Journal of Political Economy, 109*(2), 287-327. doi: https://doi.org/10.1086/319552

Diamond, D. W., & Rajan, R. G. (2005). Liquidity Shortages and Banking Crises. The *Journal of Finance, 60*(2), 615-647.

Diamond, D. W., & Rajan, R. G. (2011). Fear of Fire Sales, Illiquidity Seeking, and Credit Freezes. The *Quarterly Journal of Economics, 126*(2), 557-591.

Dietrich, A., & Wanzenried, G. (2011). Determinants of Bank Profitability Before and During the Crisis: Evidence from Switzerland. *Journal of International Financial Markets,Institutions and Money, 21*(3), 307-327.

Dietrich, A., & Wanzenried, G. (2014). The Determinants of Commercial Banking Profitability in Low-, Middle-, and High-Income Countries. The *Quarterly Review of Economics and Finance, 54*(3), 337-354.

Dinger, V., & Von Hagen, J. (2009). Does interbank Borrowing Reduce Bank Risk? *Journal of Money, Credit and Banking, 41*(2-3), 491-506.

Djalilov, K., & Piesse, J. (2016). Determinants of Bank Profitability in Transition Countries: What Matters Most? *Research in International Business and Finance, 38*, 69-82.

Drucker, S., & Puri, M. (2009). on Loan Sales, Loan Contracting, and Lending Relationships. *Review of Financial Studies, 22*(7), 2835-2872.

Drukker, D. M. (2003). Testing For Serial Correlation in Linear Panel-Data Models. *Stata Journal, 3*(2), 168-177.

Dusuki, A. W. (2007). Commodity Murabahah Programme (Cmp): An innovative Approach to Liquidity Management. *Journal of Islamic Economics, Banking and Finance, 3*(1), 1-23.

Eichengreen, B., & Gibson, H. D. (2001). *Greek Banking At the Dawn of the New Millennium*. CEPR Discussion Paper No. 2791. Retrieved from https://ssrn.com/abstract=269391

El Tiby, A. (2010). The Nature of Risk in Islamic Banking. *Islamic Banking: How to Manage Risk and Improve Profitability*, 25-45. doi: https://doi.org/10.1002-/9781118266922.ch3

Ernst & Young (2017). *Banking in Emerging Markets: GCC FinTec Play 2017.* Retrieved from https://www.ey.com/Publication/vwLUAssets/ey-banking-in-emerging-markets/$-FILE/ey-banking-in-emerging-markets.pdf

Fakih, A. (2009). *Islamic Finance in the World 2009: Analytical Report on Islamic Banks & Financial Companies*: Information and Financial Analysis Center, General Council For Islamic Banks and FinancialInstitutions.

Farahani, Y. G., & Dastan, M. (2013). Analysis of Islamic Banks' Financing and Economic Growth: A Panel Cointegration Approach. International *Journal of Islamic and Middle Eastern Finance and Management, 6*(2), 156-172.

Flamini, V., Schumacher, M. L., & Mcdonald, M. C. A. (2009). *The Determinants of Commercial Bank Profitability in Sub-Saharan Africa*: International Monetary Fund Working Paper 9-15. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=-10.1.1.372.8743&rep=rep1&type=pdf

Fu, X., Lin, Y., & Molyneux, P. (2014). Bank Competition and Financial Stability in Asia Pacific. *Journal of Banking & Finance, 38*, 64-77. doi:https://doi.org/10.1016/j.jbankfin.2013.09.012

Fungáčová, Z., Weill, L., & Zhou, M. (2017). Bank Capital, Liquidity Creation and Deposit Insurance. *Journal of Financial Services Research, 51*(1), 97-123.

Garber, P. M., & Weisbrod, S. R. (1992). The *Economics of Banking, Liquidity, and Money*. Lexington, Ma: D. C. Heath and Company

Gatev, E., Schuermann, T., & Strahan, P. E. (2009). Managing Bank Liquidity Risk: How Deposit-Loan Synergies Vary with Market Conditions. *Review of Financial Studies, 22*(3), 995-1020.

Gavin, M., & Hausmann, R. (1996). The *Roots of Banking Crises: the Macroeconomic Context.* inter-American Development Bank, office of the Chief Economist Working Paper No. 318. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?-doi=10.1.1.31.4327&rep=rep1&type=pdf

Gennotte, G., & Pyle, D. (1991). Capital Controls and Bank Risk. *Journal of Banking & Finance, 15*(4), 805-824.

Giordana, G., & Schumacher, I. (2011). The *Impact of the Basel III Liquidity Regulations on the Bank Lending Channel: A Luxembourg Case Study*: Central Bank of Luxembourg Working Paper No. 61. Retrieved from http://www.bcl.lu/fr/publications/cahiers_etudes/61/-bclwp061.pdf

Giordana, G. A., & Schumacher, I. (2013). Bank Liquidity Risk and Monetary Policy. Empirical Evidence on the Impact of Basel III Liquidity Standards. International *Review of Applied Economics, 27*(5), 633-655. doi:10.1080/02692171.2013.778821

Giordana, G. A., & Schumacher, I. (2017). An Empirical Study on the Impact of Basel III Standards on Banks' Default Risk: the Case of Luxembourg. *Journal of Risk and Financial Management, 10*(2), 8. doi:https://doi.org/10.3390/jrfm10020008

Gobat, J., Yanase, M., & Maloney, J. (2014). The *Net Stable Funding Ratio: Impact and Issues For Consideration.* International Monetory Fund Working Paper No. 106-2014. doi: http://dx.doi.org/10.5089/9781498346498.001

Goddard, J., Liu, H., Molyneux, P., & Wilson, J. O. (2011). The Persistence of Bank Profit. *Journal of Banking & Finance, 35*(11), 2881-2890.

Golin, J., & Delhaise, P. (2013). The *Bank Credit Analysis Handbook: A Guide For Analysts, Bankers and investors*: John Wiley & Sons.

Gorton, G., & Metrick, A. (2012). Securitized Banking and the Run on Repo. *Journal of Financial Economics, 104*(3), 425-451.

Gorton, G., & Winton, A. (2017). Liquidity Provision, Bank Capital, and the Macroeconomy. *Journal of Money, Credit and Banking, 49*(1), 5-37. doi:https://doi.org/10.1111/jmcb.12367.

Greene, W. H. (2003). *Econometric Analysis.* India: Pearson Education.

Gujarati, D. N. (2009). *Basic Econometrics.* India: Tata Mcgraw-Hill Education.

Guru, B. K., Staunton, J., & Balashanmugam, B. (2002). Determinants of Commercial Bank Profitability in Malaysia. *Journal of Money, Credit, and Banking, 17*, 69-82.

Hainz, C., Weill, L., & Godlewski, C. J. (2013). Bank Competition and Collateral: Theory and Evidence. *Journal of Financial Services Research, 44*(2), 131-148.

Halling, M., & Hayden, E. (2006). Bank Failure Prediction: A Two-Step Survival Time Approach. *IFC Bulletin, 56*, 48-73.

Hannan, T. H., & Hanweck, G. A. (1988). Bank Insolvency Risk and the Market For Large Certificates of Deposit. *Journal of Money, Credit and Banking, 20*(2), 203-211.

Hardy, D. C., & Pazarbaşioğlu, C. (1999). Determinants and Leading Indicators of Banking Crises: Further Evidence. *IMF Staff Papers*, 247-258.

Haron, S. (1996). Competition and Other External Determinants of the Profitability of Islamic Banks. *Islamic Economic Studies, 4*(1), 49-64.

Haron, S. (2004). Determinants of Islamic Bank Profitability. *Global Journal of Finance and Economics, 1*(1), 11-33.

Hasan, M., & Dridi, J. (2011). The Effects of the Global Crisis on Islamic and Conventional Banks: A Comparative Study. *Journal of International Commerce, Economics and Policy, 2*(2), 163-200.

Hassan, K., & Lewis, M. (2009). *Handbook of Islamic Banking.* USA : Edward Elgar Publishing.

Hassan, M. K., & Bashir, A. H. M. (2003). Determinants of Islamic Banking Profitability. in *10th Erf Annual Conference, Morocco* . Retrieved from https://www.researchgate.net/profile/-abdel_hameed_bashir/publication/228846468_determinants_of_islamic_banking_profitability/links/0f317534633668a3f4000000.pdf

He, Z., & Xiong, W. (2012). Rollover Risk and Credit Risk. The *Journal of Finance, 67*(2), 391-430.

Hill, R. C., Griffiths, W. E., & Lim, G. C. (2008). *Principles of Econometrics* (Vol. 5). Hoboken, New Jersey: Wiley

Holmes, Z., & Kathpalia, S. (2014). *Standard & Poor's Islamic Finance Outlook 2014*. Retrieved from https://www.spratings.com/documents/20184/86966/islamic_finance_outlook_-2016_v2/4d9d6fd9-3b11-4ae2-9168-13ee2543b73b

Holmstrom, B., & Tirole, J. (1997). Financial intermediation, Loanable Funds, and the Real Sector. The *Quarterly Journal of Economics, 112*(3), 663-691.

Holmström, B., & Tirole, J. (1998). Private and Public Supply of Liquidity. *Journal of Political Economy, 106*(1), 1-40.

Hong, H., Huang, J.-Z., & Wu, D. (2014). The Information Content of Basel III Liquidity Risk Measures. *Journal of Financial Stability, 15*, 91-111.

Horvath, R., Seidler, J., & Weill, L. (2012). Bank Capital and Liquidity Creation: Granger-Causality Evidence. *Journal of Financial Services Research*, *45*(3), 341-361.

Horvath, R., Seidler, J., & Weill, L. (2016). How Bank Competition Influences Liquidity Creation. *Economic Modelling, 52*, 155-161.

Iannotta, G., Nocera, G., & Sironi, A. (2007). Ownership Structure, Risk and Performance in the European Banking Industry. *Journal of Banking & Finance, 31*(7), 2127-2149.

Ibrahim, M. H., & Rizvi, S. A. R. (2017). Do We Need Bigger Islamic Banks? An Assessment of Bank Stability. *Journal of Multinational Financial Management, 40*, 77-91. doi:https://doi.org/10.1016/j.mulfin.2017.05.002

ICD, & Reuters. (2015). *Islamic Finance Development Report 2015: Global Transformation*. Retrieved from https://ceif.iba.edu.pk/pdf/thomsonreuters-islamicfinance-developmentreport2015globaltransformation.pdf

Idris, A. R., Asari, F. F. H. A., Taufik, N. A. A., Salim, N. J., Mustaffa, R., & Jusoff, K. (2011). Determinant of Islamic BankingInstitutions' Profitability in Malaysia. *World Applied Sciences Journal, 12*, 01-07.

IFSB. (2015). *Guidance Note on Quantitative Measures For Liquidity Risk Management in Institutions Offering Islamic Financial Services [Excluding Islamic Insurance (Takāful) Institutions and Islamic Collective investment Schemes]*: Islamic Financial Services Board. Retrieved from http://www.ifsb.org/standard/gn6%20gn%20on%20lrm%20-(december%202015)%20(final).pdf

IFSB. (2017). *Islamic Financial Services Industry Stability Report*: Islamic Financial Services Board. Retrieved from https://www.ifsb.org/docs/IFSB%20IFSI%20Stability%20-Report%202017.pdf

Imbierowicz, B., & Rauch, C. (2014). The Relationship Between Liquidity Risk and Credit Risk in Banks. *Journal of Banking & Finance, 40*, 242-256.

Iqbal, M., & Molyneux, P. (2005). *Thirty Years of Islamic Banking: History, Performance, and Prospects*. Uk: Palgrave Macmillan.

Iqbal, Z., & Mirakhor, A. (2011). *An introduction to Islamic Finance: Theory and Practice.* 2nd Ed. USA : John Wiley & Sons.

Iskandar-Datta, M., & Mclaughlin, R. (2005). Global Diversification: Evidence from Corporate Operating Performance. *Corporate Ownership & Control*, *4*(4), 228-242.

Ismal, R. (2008). Shariah Issues in Liquidity Risk Management: A Survey. *Review of Islamic Economics, 12*(2), 45-66.

Jiraporn, P., Chalermchatvichien, P., & Jumreornvong, S. (2014). Basel III, Capital Stability, Risk-Taking, Ownership: Evidence from Asia. *Journal of Multinational Financial Management, 28*, 28-46.

Kaminsky, G. L., & Reinhart, C. M. (1999). The Twin Crises: the Causes of Banking and Balance-of-Payments Problems. *American Economic Review*, *89*(3), 473-500.

Karim, B. K., Sami, B. A. M., & Hichem, B.-K. (2010). Bank-Specific, Industry-Specific and Macroeconomic Determinants of African Islamic Banks' Profitability. International *Journal of Business and Management Science, 3*(1), 39-56.

Karim, N. A., Al-Habshi, S. M. S. J., & Abduh, M. (2016). Macroeconomics Indicators and Bank Stability: A Case of Banking in Indonesia. *Bulletin of Monetary Economics and Banking (Buletin Ekonomi Moneter Dan Perbankan), 18*(4), 431-448.

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks As Liquidity Providers: An Explanation For the Coexistence of Lending and Deposit-Taking. The *Journal of Finance, 57*(1), 33-73.

Kerr, S. (2007, June, 8). Difc Raises $1.25bn Via Sukuk. *Financial Times*. Retrieved from https://www.ft.com/content/49420018-1528-11dc-b48a-000b5df10621

Khan, F. (2010). How 'Islamic'is Islamic Banking? *Journal of Economic Behavior & Organization, 76*(3), 805-820.

Khan, T., & Ahmed, H. (2001). *Risk Management: An Analysis of Issues in Islamic Financial Industry.* Islamic Development Bank, Islamic Research and Training Institute.

Khrawish, H. A. (2011). Determinants of Commercial Banks Performance: Evidence from Jordan. International *Research Journal of Finance and Economics, 81*, 148-159.

King, M. R. (2013). The Basel III Net Stable Funding Ratio and Bank Net Interest Margins. *Journal of Banking & Finance, 37*(11), 4144-4156.

Köhler, M. (2014). Does Non-Interest Income Make Banks More Risky? Retail Versus Investment Oriented Banks. *Review of Fianancial Economics, 23*(4), 182-193. doi: https://doi.org/10.1016/j.rfe.2014.08.001

Köhler, M. (2015). Which Banks Are More Risky? the Impact of Business Models on Bank Stability. *Journal of Financial Stability, 16*, 195-212.

Kosmidou, K. (2008). The Determinants of Banks' Profits in Greece During the Period of Eu Financial integration. *Managerial Finance, 34*(3), 146-159.

Kosmidou, K., Tanna, S., & Pasiouras, F. (2005). *Determinants of Profitability of Domestic UK Commercial Banks: Panel Evidence from the Period 1995-2002*. Economics, Finance and Accounting Applied Research Working Paper No. Rp08-4. Coventry: Coventry University. Retrieved from https://curve.coventry.ac.uk/open/file/0e96868a-c91f-7854-ffc7-b1d58eb809ed/1/determinants%20of%20profitability.pdf

Koziol, C., & Lawrenz, J. (2009). What Makes A Bank Risky? Insights from the Optimal Capital Structure of Banks. *Journal of Banking & Finance, 33*(5), 861-873.

Kwan, S., & Eisenbeis, R. A. (1997). Bank Risk, Capitalization, and Operating Efficiency. *Journal of Financial Services Research, 12*(2-3), 117-131.

Laeven, L., & Levine, R. (2009). Bank Governance, Regulation and Risk Taking. *Journal of Financial Economics, 93*(2), 259-275.

Lee, C. C., & Hsieh, M. F. (2013). The Impact of Bank Capital on Profitability and Risk in Asian Banking. *Journal of International Money and Finance, 32*, 251-281.

Lee, C. C., & Hsieh, M. F. (2014). Bank Reforms, Foreign Ownership, and Financial Stability. *Journal of International Money and Finance, 40*, 204-224.

Leijonhufvud, A., &. (2007). *Monetary and Financial Stability. CEPR Policy Insight No. 14*. Retrieved from http://hdl.handle.net/11572/21474

Lepetit, L., Nys, E., Rous, P., & Tarazi, A. (2008). Bank Income Structure and Risk: An Empirical Analysis of European Banks. *Journal of Banking & Finance, 32*(8), 1452-1467.

Lepetit, L., & Strobel, F. (2013). Bank Insolvency Risk and Time-Varying Z-Score Measures. *Journal of International Financial Markets, Institutions and Money, 25*, 73-87.

Lewis, M. K., & Algaoud, L., &. (2001). *Islamic Banking.* USA: Edward Elgar.

Li, Y. (2007). *Determinants of Banks' Profitability and Its Implication on Risk Management Practices: Panel Evidence from the Uk in the Period 1999-2006* (Dissertation). The University of Nottingham. Retrieved from http://eprints.nottingham.ac.uk-/21374/2/07mayuqili.pdf

Love, I., & Pería, M. S. M. (2015). How Bank Competition Affects Firms' Access to Finance. The *World Bank Economic Review, 29*(3), 413-448.

Maddala, G. S., & Wu, S. (1999). A Comparative Study of Unit Root Tests with Panel Data and A New Simple Test. *Oxford Bulletin of Economics and Statistics, 61*(S1), 631-652.

Matz, L., & Neu, P. (2006). *Liquidity Risk Measurement and Management: A Practitioner's Guide to Global Best Practices.* John Wiley & Sons.

Mehran, H., & Thakor, A. (2011). Bank Capital and Value in the Cross-Section. The *Review of Financial Studies, 24*(4), 1019-1067.

Mercieca, S., Schaeck, K., & Wolfe, S. (2007). Small European Banks: Benefits from Diversification? *Journal of Banking & Finance, 31*(7), 1975-1998.

Merton, R. C. (1977). An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees An Application of Modern Option Pricing Theory. *Journal of Banking & Finance, 1*(1), 3-11.

Mesa, R. B., Sánchez, H. M., & Sobrino, J. N. R. (2014). Main Determinants of Efficiency and Implications on Banking Concentration in the European Union. *Revista De Contabilidad, 17*(1), 78-87. doi:https://doi.org/10.1016/j.rcsar.2013.08.006

Miller, T., Holmes, K. R., & Feulner, E. J. (2013). *2013 Index of Economic Freedom*: Wall Street Journal. Retrieved from https://www.heritage.org/index/pdf/2013/book-/index_2013.pdf

Mirzaei, A. (2011). The Effect of Market Power on Stability and Performance of Islamic and Conventional Banks. *Islamic Economic Studies, 18*, 45-84.

Mirzaei, A., Moore, T., & Liu, G. (2013). Does Market Structure Matter on Banks' Profitability and Stability? Emerging Vs. Advanced Economies. *Journal of Banking & Finance, 37*(8), 2920-2937.

Mishkin, F. S. (1999). Financial Consolidation: Dangers and Opportunities. *Journal of Banking & Finance, 23*(2), 675-691.

Moghadam, A. K. (2015). Economic Freedom and Banking Stability in Selected Countries. *Journal of Money and Economy, 8*(4), 137-157.

Mohamad, A. A. S., Mohamad, M. T., & Samsudin, M. L. (2013). How Islamic Banks of Malaysia Managing Liquidity? An Emphasis on Confronting Economic Cycles. International *Journal of Business and Social Science, 4*(7), 253-263.

Molyneux, P., & Thornton, J. (1992). Determinants of European Bank Profitability: A Note. *Journal of Banking & Finance, 16*(6), 1173-1178.

Molyneux, P., & Yip, J. (2013). Income Diversification and Performance of Islamic Banks. *Journal of Financial Management, Markets and Institutions, 1*(1), 47-66.

Muda, M., Shaharuddin, A., & Embaya, A. (2013). Comparative Analysis of Profitability Determinants of Domestic and Foreign Islamic Banks in Malaysia. International *Journal of Economics and Financial Issues, 3*(3), 559-569.

Muharam, H., & Kurnia, H. P. (2012). The *Influence of Fundamental Factors to Liquidity Risk on Banking Industry: Comparative Study Between Islamic Bank and Conventional Bank* in *Indonesia*. Business, Accounting, and Management (CBAM) 2012, Unissula, Semarang Indonesia. Retrieved from http://dx.doi.org/10.2139/ssrn.2339598

Munteanu, I. (2012). Bank Liquidity and Its Determinants in Romania. *Procedia Economics and Finance, 3*, 993-998.

Naceur, S. B. (2003). The *Determinants of the Tunisian Banking Industry Profitability: Panel Evidence.* Universite Libre De Tunis, Department of Finance Working Paper 2003. Retrieved from http://www.mafhoum.com/press6/174e11.pdf

Naceur, S. B., & Kandil, M. (2009). The Impact of Capital Requirements on Banks' Cost of intermediation and Performance: the Case of Egypt. *Journal of Economics and Business, 61*(1), 70-89.

Nguyen, M., Skully, M., & Perera, S. (2013). The Relation Between Bank Liquidity and Stability: Does Market Power Matter?. in *6th Financial Risks International Forum, Prix Académique De La Recherche En Management, Paris*. Retrieved from http://www.financialrisksforum-.com/risk2013/work/6394870.pdf

Olagunju, A., David, A., & Samuel, O. (2012). Liquidity Management and Commercial Banks' Profitability in Nigeria. *Research Journal of Finance and Accounting, 2*(7-8), 24-38.

Ommeren, S. V. (2011). *An Examination of the Determinants of Banks' Profitability in the European Banking Sector.* Erasmus University Rotterdam, Erasmus School of Economics, Department of Accounting & Finance, Masters the sis. October 14th, 2011.

Painceira, P. J. (2010). The Role of Banks in the Korean Financial Crisis of 1997: An interpretation Based on the Financial Instability Hypothesis. in: Tavasci D., Toporowski J. (Eds) Minsky, Crisis and Development. Palgrave Macmillan, London.

Pasiouras, F., & Kosmidou, K. (2007). Factors Influencing the Profitability of Domestic and Foreign Commercial Banks in the European Union. *Research in International Business and Finance, 21*(2), 222-237.

Perry, P. (1992). Do Banks Gain Or Lose from Inflation? *Journal of Retail Banking, 14*(2), 25-31.

Petersen, M. A., & Rajan, R. G. (1995). The Effect of Credit Market Competition on Lending Relationships. The *Quarterly Journal of Economics, 110*(2), 407-443.

Powell, D., &. (2016). *Quantile Treatment Effects in the Presence of Covariates*: Working Papers. Retrieved from https://works.bepress.com/david_powell/4/

Rachdi, H., & Mokni, R. B. S. (2014). Assessing the Bank Profitability in the Mena Region: A Comparative Analysis Between Conventional and Islamic Bank. International *Journal of Islamic and Middle Eastern Finance and Management, 7*(3), 305-332.

Rahman, A. A. (2010). Financing Structure and Insolvency Risk Exposure of Islamic Banks. *Financial Markets and Portfolio Management, 24*(4), 419-440.

Ramakrishnan, R. T., & Thakor, A. V. (1984). Information Reliability and A Theory of Financial Intermediation. The *Review of Economic Studies, 51*(3), 415-432.

Rauch, C., Steffen, S., Hackethal, A., & Tyrell, M. (2009). *Savings Banks, Liquidity Creation and Monetary Policy.* Germany: Goethe University.

Repullo, R. (2004). Capital Requirements, Market Power, and Risk-Taking in Banking. *Journal of Financial intermediation, 13*(2), 156-182.

Rhaguram, R. (2005). Has Financial Development Made the World Riskier? The Greenspan Era: Lessons For the Future. Symposium Conducted At the Meeting of the Federal Reserve Bank of Kansas City, Kansas City:. Retrieved from http://www.kc.frb.org/publicat/sympos/2005/pdf/rajan2005. pdf

Roodman, D. (2009a). How to Do Xtabond2: An introduction to Difference and System GMM in Stata. *Stata Journal, 9*(1), 86-136.

Roodman, D. (2009b). A Note on the Theme of Too Many Instruments*. *Oxford Bulletin of Economics and Statistics, 71*(1), 135-158.

Rosly, S. A. (2005). *Critical Issues on Islamic Banking and Financial Markets: Islamic Economics, Banking and Finance, investments, Takaful and Financial Planning*: Dinamas Publishing.

Roulet, C. (2011). *Empirical Essays on Bank Liquidity Creation and Maturity Transformation Risk: Implications For Prudential Regulation*. Université De Limoges.

Saad, W., & El-Moussawi, C. (2012). The Determinants of Net Interest Margins of Commercial Banks in Lebanon. *Journal of Money, investment and Banking, 23*, 118-132.

Saunders, A., & Cornett, M. M. (2007). *Financial Markets andInstitutions: An introduction to the Risk Management Approach.* New York: Mcgraw-Hill International Edition.

Schaeck, K., & Cihak, M. (2012). Banking Competition and Capital Ratios. *European Financial Management, 18*(5), 836-866.

Schaeck, K., & Cihák, M. (2014). Competition, Efficiency, and Stability in Banking. *Financial Management, 43*(1), 215-241.

Schaeck, K., Cihak, M., & Wolfe, S. (2009). Are Competitive Banking Systems More Stable? *Journal of Money, Credit and Banking, 41*(4), 711-734.

Schwartz, A. J. (1995). Why Financial Stability Despends on Price Stability. *Economic Affairs, 15*(4), 21-25.

Shen, C.-H., Chen, Y.-K., Kao, L.-F., & Yeh, C.-Y. (2009). *Bank Liquidity Risk and Performance*: Department of Finance: National University of Kaohsiung.

Short, B. K. (1979). The Relation Between Commercial Bank Profit Rates and Banking Concentration in Canada, Western Europe, and Japan. *Journal of Banking & Finance, 3*(3), 209-219.

Smaoui, H., & Salah, I. B. (2012). Profitability of Islamic Banks in the GCC Region. *Global Economy and Finance Journal, 5*(1), 85-102.

Smirlock, M. (1985). Evidence on the (Non) Relationship Between Concentration and Profitability in Banking. *Journal of Money, Credit and Banking, 17*(1), 69-83.

Smith, A. (1937). The *Wealth of Nations [1776]*. New York: Modern Library.

Srairi, S. A. (2009). Factors Influencing the Profitability of Conventional and Islamic Commercial Banks in GCCCountries. *Review of Islamic Economics, 13*(1), 5-30.

Staikouras, C. K., & Wood, G. E. (2011). The Determinants of European Bank Profitability. International *Business & Economics Research Journal, 3*(6).

Stiroh, K. J. (2006). A Portfolio View of Banking with Interest and Noninterest Activities. *Journal of Money, Credit and Banking, 38*(5), 1351-1361.

Sufian, F. (2011). Profitability of the Korean Banking Sector: Panel Evidence on Bank-Specific and Macroeconomic Determinants. *Journal of Economics and Management, 7*(1), 43-72.

Sufian, F., & Habibullah, M. S. (2009). Bank Specific and Macroeconomic Determinants of Bank Profitability: Empirical Evidence from the China Banking Sector. *Frontiers of Economics in China, 4*(2), 274-291.

Sufian, F., & Habibullah, M. S. (2010). Does Economic Freedom Fosters Banks' Performance? Panel Evidence from Malaysia. *Journal of Contemporary Accounting & Economics, 6*(2), 77-91. doi:https://doi.org/10.1016/j.jcae.2010.09.003

Sufian, F., & Habibullah, M. S. (2012). Globalizations and Bank Performance in China. *Research in International Business and Finance, 26*(2), 221-239. doi:https://doi.org/10.1016/j.ribaf.2011.12.005

Sufian, F., & Habibullah, M. S. (2014). Economic Freedom and Bank Efficiency: Does Ownership and Origins Matter? *Journal of Financial Regulation and Compliance, 22*(3), 174-207.

Templeton, W. K., & Severiens, J. T. (1992). The Effect of Nonbank Diversification on Bank Holding Company Risk. *Quarterly Journal of Business and Economics*, 3-17.

Tesfaye, R. (2012). The *Link Between Financial Development and Economic Growth in Ethiopia*. Addis Ababa University.

Trad, N., Trabelsi, M. A., & Goux, J. F. (2017). Risk and Profitability of Islamic Banks: A Religious Deception Or An Alternative Solution? *European Research on Management and Business Economics, 23*(1), 40-45. doi:https://doi.org/10.1016/j.iedeen.2016.09.001

Triki, T., Kouki, I., Dhaou, M. B., & Calice, P. (2017). Bank Regulation and Efficiency: What Works For Africa? *Research in International Business and Finance, 39*(Part A), 183-205. doi:https://doi.org/10.1016/j.ribaf.2016.07.027

Turk-Ariss, R. (2010). on the Implications of Market Power in Banking: Evidence from Developing Countries. *Journal of Banking & Finance, 34*(4), 765-775.

Van Den Heuvel, S. J. (2002). The Bank Capital Channel of Monetary Policy. The *Wharton School, University of Pennsylvania*. Retrieved from http://citeseerx.ist.psu.-edu/viewdoc/download?doi=10.1.1.539.4985&rep=rep1&type=pdf

Van Greuning, H., & Bratanovic, S. B. (2009). *Analyzing Banking Risk: A Framework For Assessing Corporate Governance and Risk Management*: World Bank Publications. Retrieved from Http://Documents.Worldbank.Org/Curated/En-/361471468336562959/AnalyzingBanking-Risk-A-Framework-For-Assessing-Corporate-Governance-And-Risk-Management

Visser, H. (2013). *Islamic Finance: Principles and Practice*: Edward Elgar Publishing.

Vodová, P. (2011). Liquidity of Czech Commercial Banks and Its Determinants. International *Journal of Mathematical Models and Methods in Applied Sciences, 5*(6), 1060-1067.

Vodová, P. (2013). Determinants of Commercial Bank Liquidity in Hungary. *Finansowy Kwartalnik internetowy E-Finanse, 9*(3), 64-71.

Wagner, W. (2007). The Liquidity of Bank Assets and Banking Stability. *Journal of Banking & Finance, 31*(1), 121-139.

Waldo, D. G. (1985). Bank Runs, the Deposit-Currency Ratio and the Interest Rate. *Journal of Monetary Economics, 15*(3), 269-277.

Wasiuzzaman, S., & Tarmizi, H. (2010). Profitability of Islamic Banks in Malaysia: An Empirical Analysis. *Journal of Islamic Economics, Banking and Finance, 6*(4), 53-68.

White, W. R. (2006). Is Price Stability Enough? BIS Working Paper No. 205. Retrieved from ssrn: https://ssrn.com/abstract=900074

Windmeijer, F. (2005). A Finite Sample Correction For the Variance of Linear Efficient Two-Step Gmm Estimators. *Journal of Econometrics, 126*(1), 25-51.

Wooldridge, J. M. (2001). Applications of Generalized Method of Moments Estimation. The *Journal of Economic Perspectives, 15*(4), 87-100.

Yan, M., Hall, M. J., & Turner, P. (2012). A Cost–Benefit Analysis of Basel III: Some Evidence from the Uk. International *Review of Financial Analysis, 25*, 73-82.

Yanikkaya, H., Gumus, N., & Pabuccu, Y. U. (2018). How profitability differs between conventional and Islamic banks: A dynamic panel data approach. *Pacific-Basin Finance Journal*, 48, 99-111.

Yeager, F. C., & Seitz, N. E. (1989). *Financial Institution Management: Text and Cases.* 3rd Ed. Englewood Cliffs, New Jersey: Prentice Hall inc.

Zarrouk, H., Jedidia, K. B., & Moualhi, M. (2016). Is Islamic Bank Profitability Driven By Same Forces As Conventional Banks? International *Journal of Islamic and Middle Eastern Finance and Management, 9*(1), 46-66.

Zhou, C. (2010). Are Banks Too Big to Fail? Measuring Systemic Importance of FinancialInstitutions. International *Journal of Central Banking, 6*(4), 205-250.